U.S. AIR FORCE

Investigation and Analysis Of Human Factors

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Life Sciences Branch

DSN 246-0880

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Introduction

- FY00 Overview
- Overview of Human Error Models
- Review USAF Human Factor Taxonomy
  - Individual Factors
  - Environmental Factors
- Investigation and Analysis
  - Integration of Aircraft Mishaps

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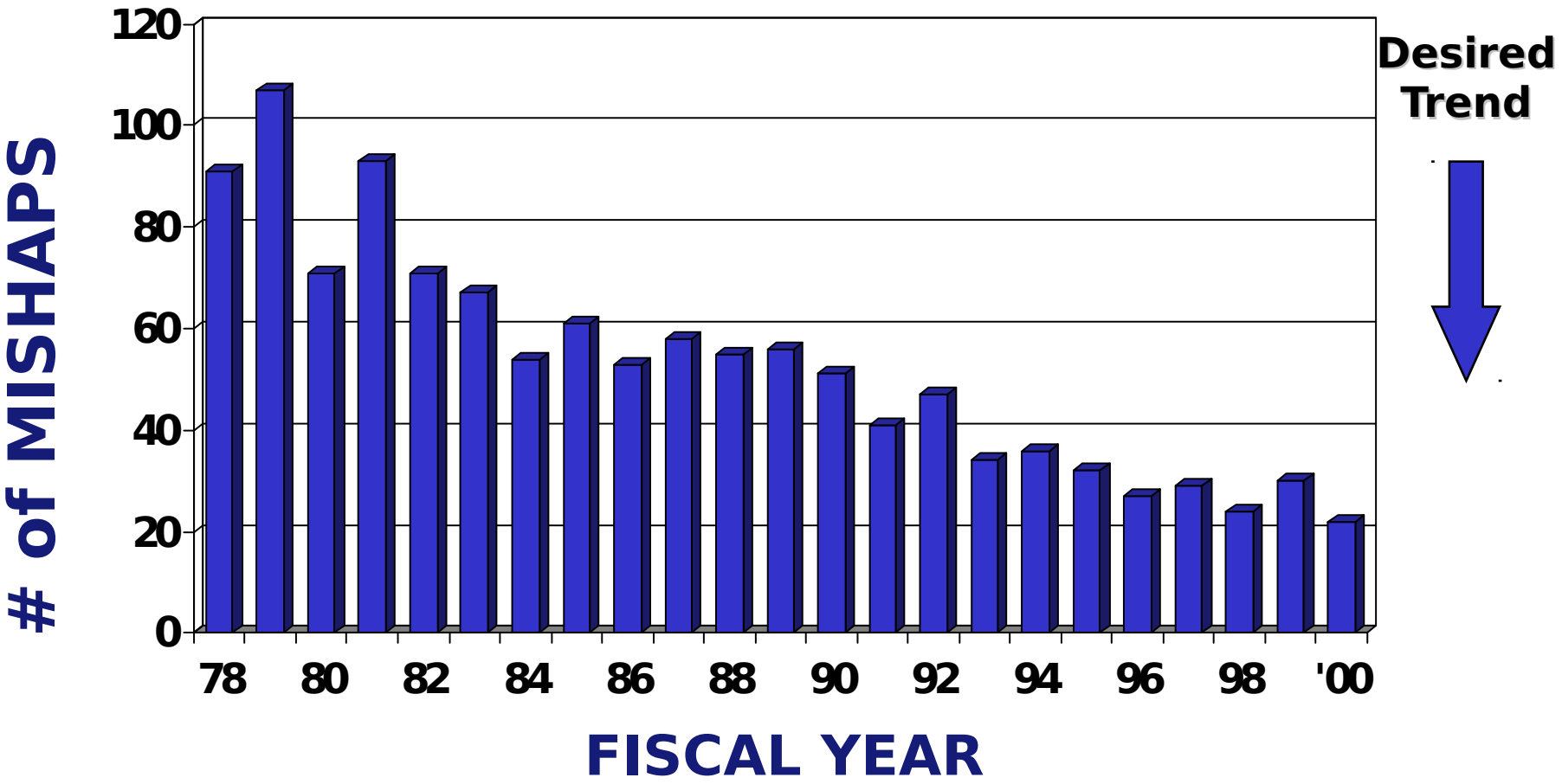
CLASS A FLIGHT MISHAPS
FY 78 - FY 00



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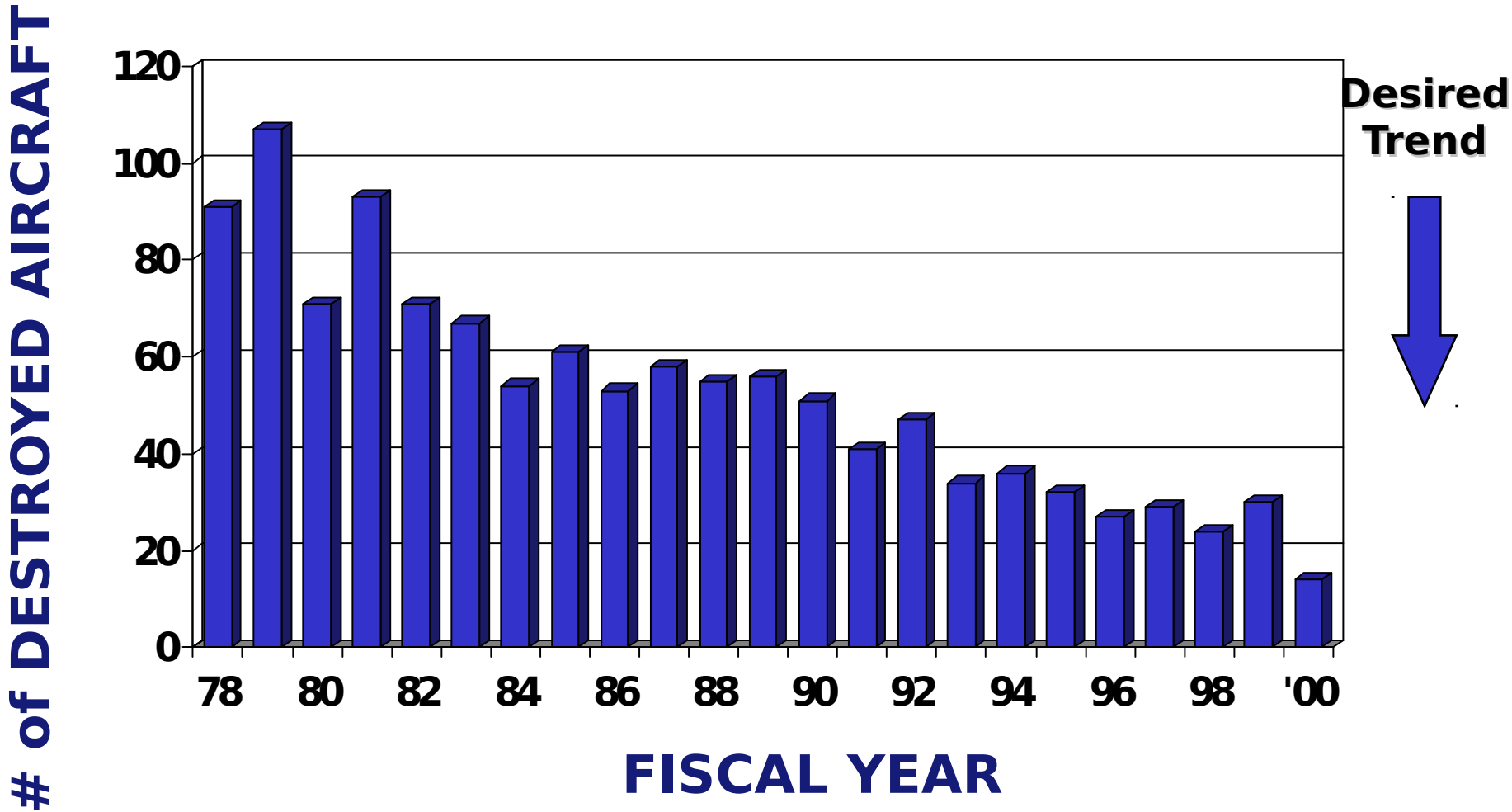
DESTROYED AIRCRAFT: FY 78 – FY 00



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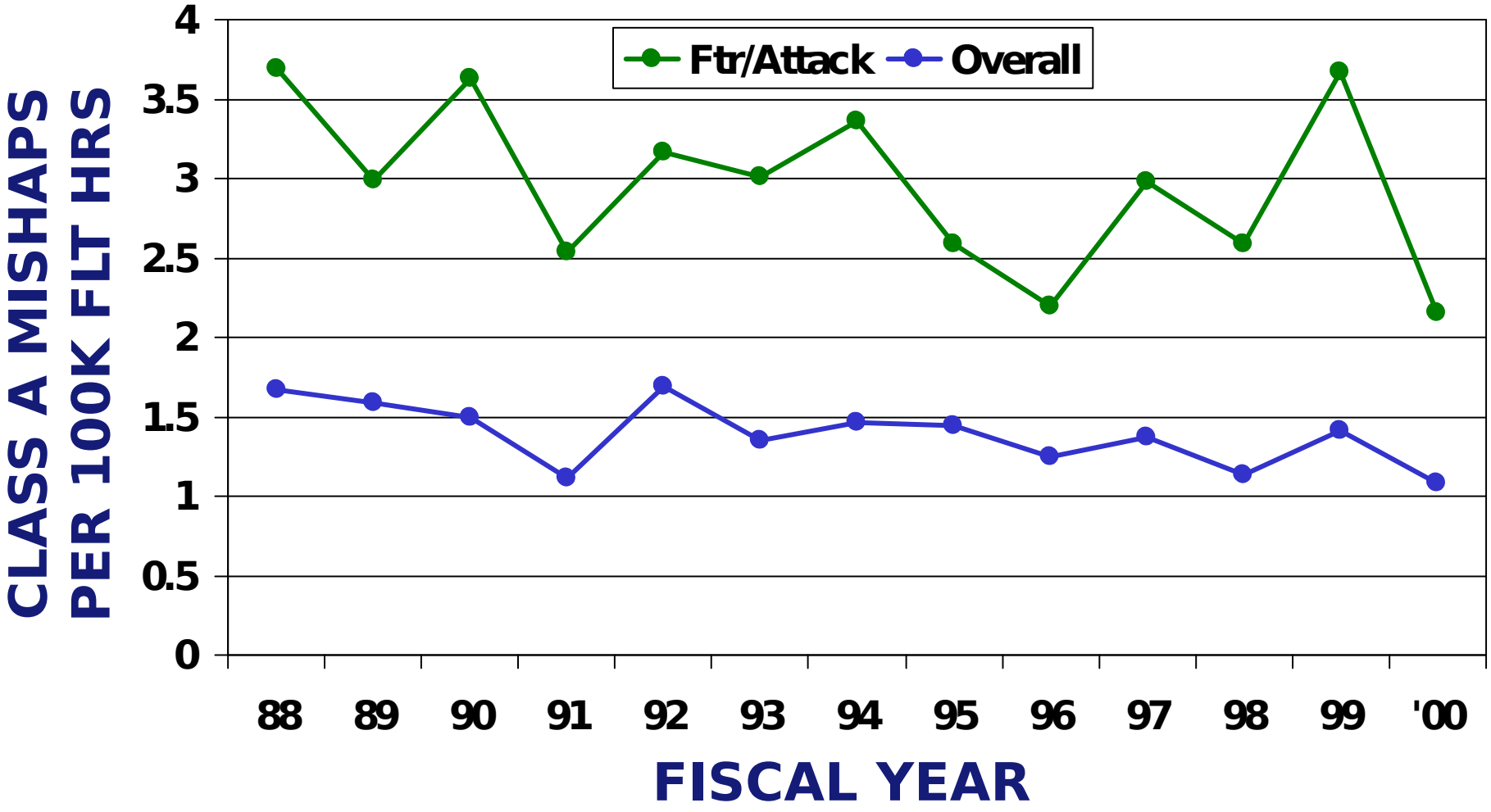
CLASS A MISHAP RATES



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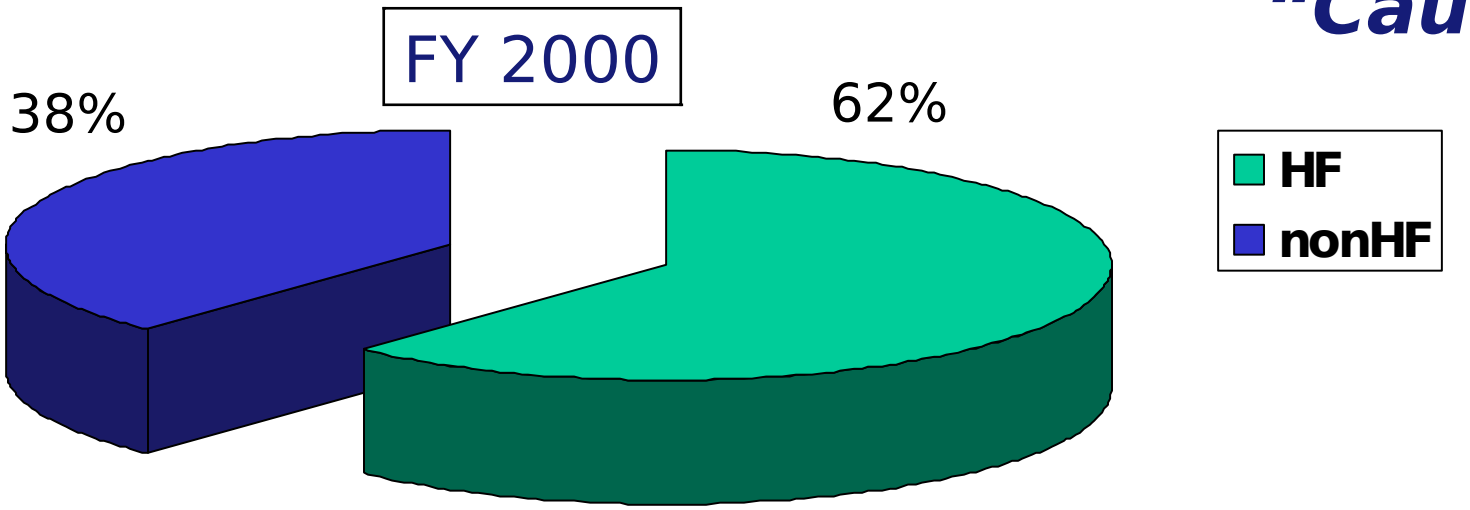
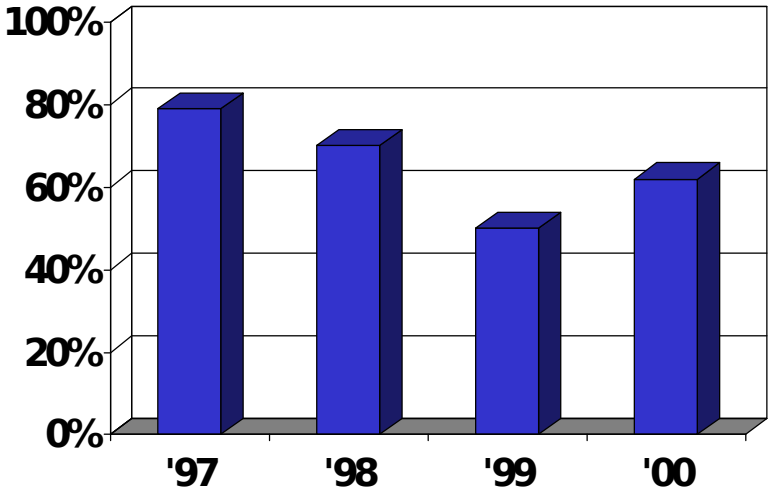
CLASS A MISHAPS:
Human Factors "Major" or "Causal"



% Mishaps With Major or Causal HF



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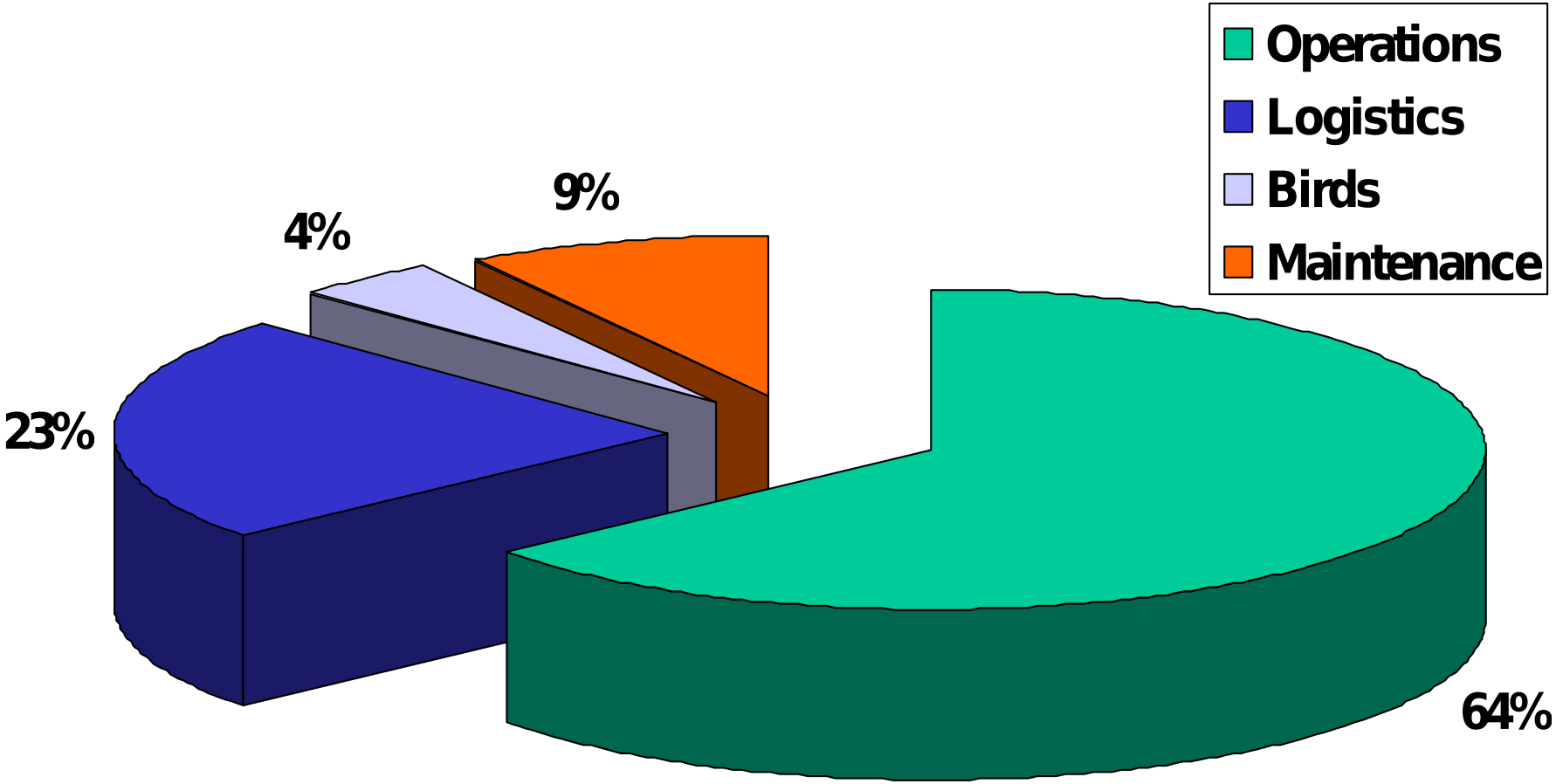
FY 00 Class A Mishaps



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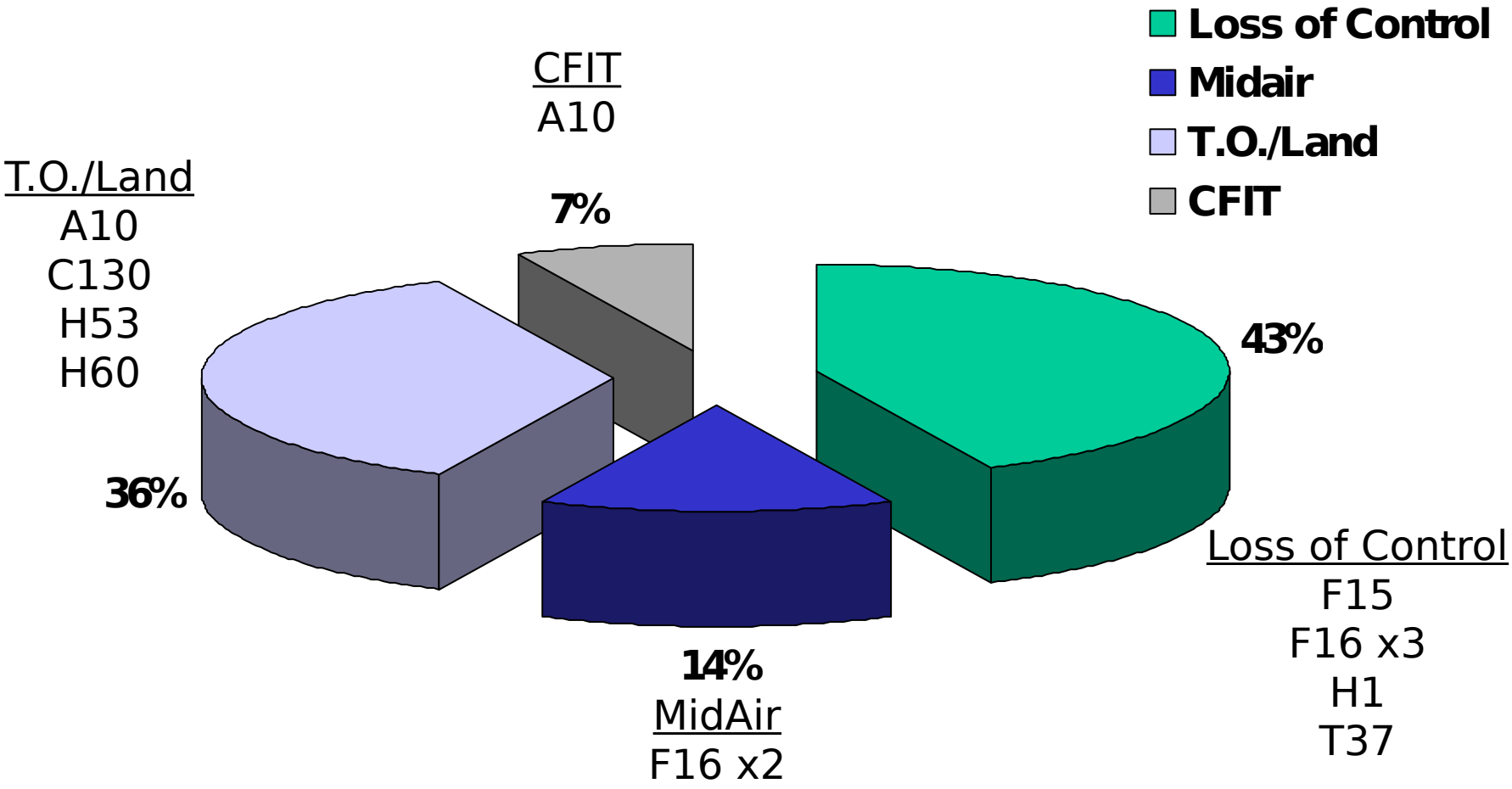
Ops Causes



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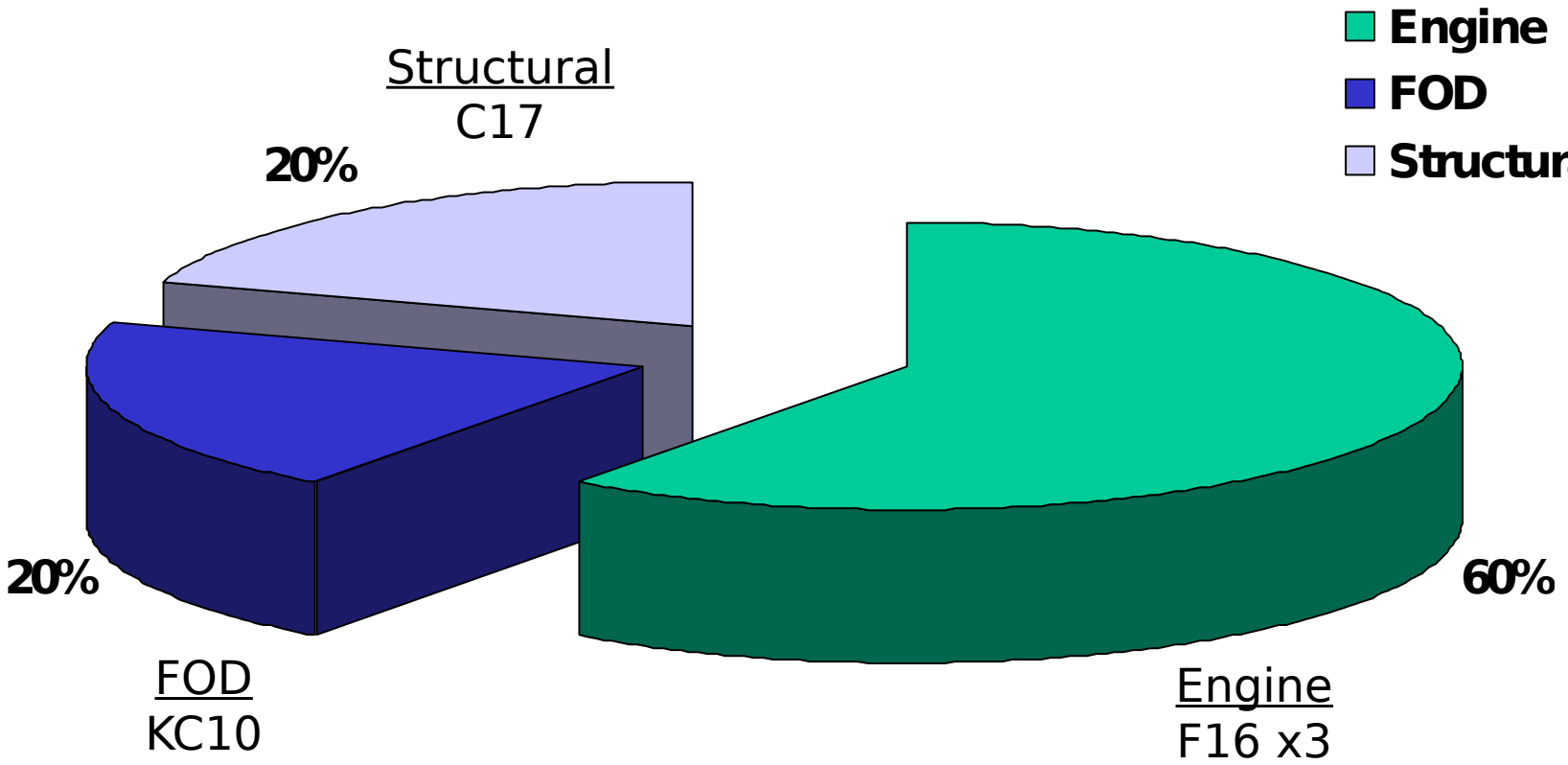
Logistics Causes



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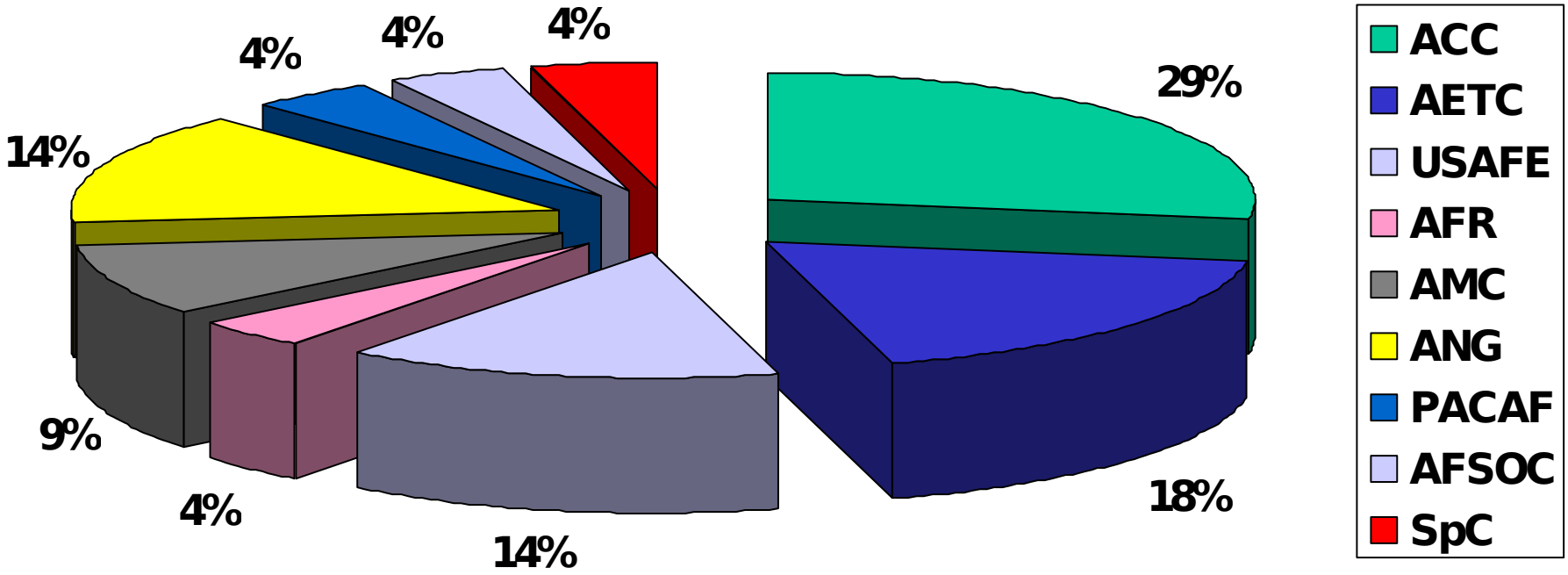
Class A Mishaps by MAJCOM



Class A Mishap Rates by MAJCOM

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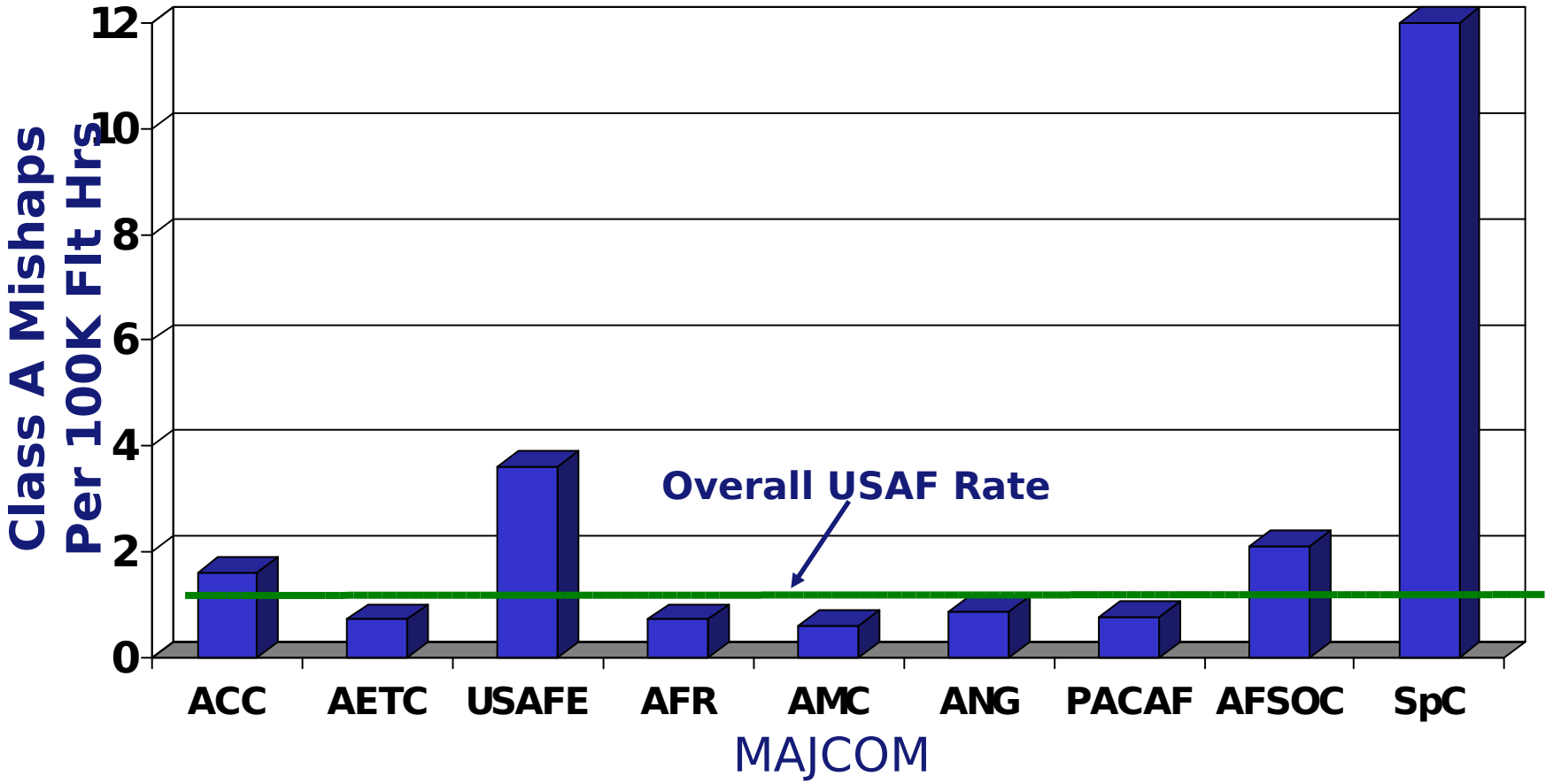

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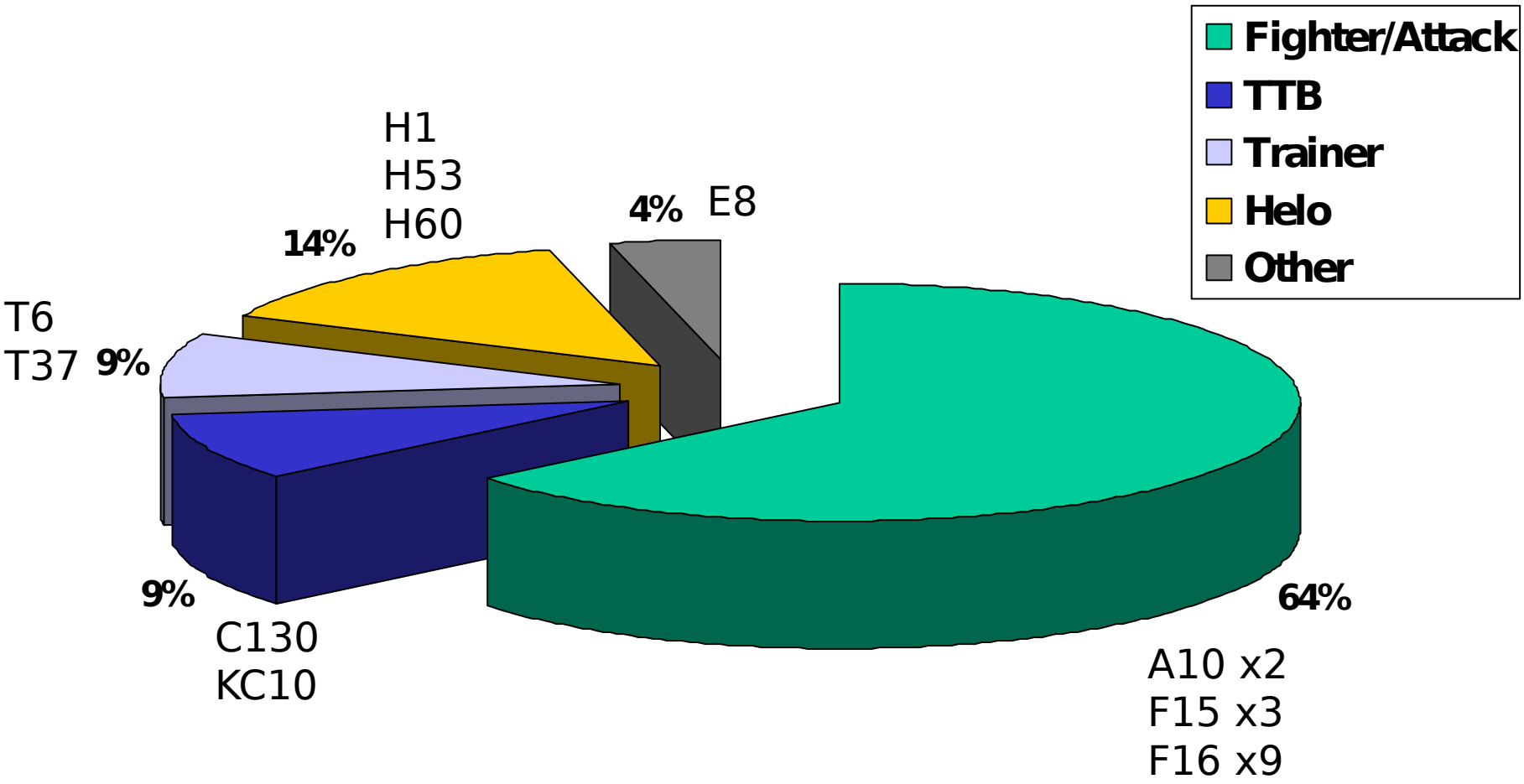
Class A Mishaps by Aircraft



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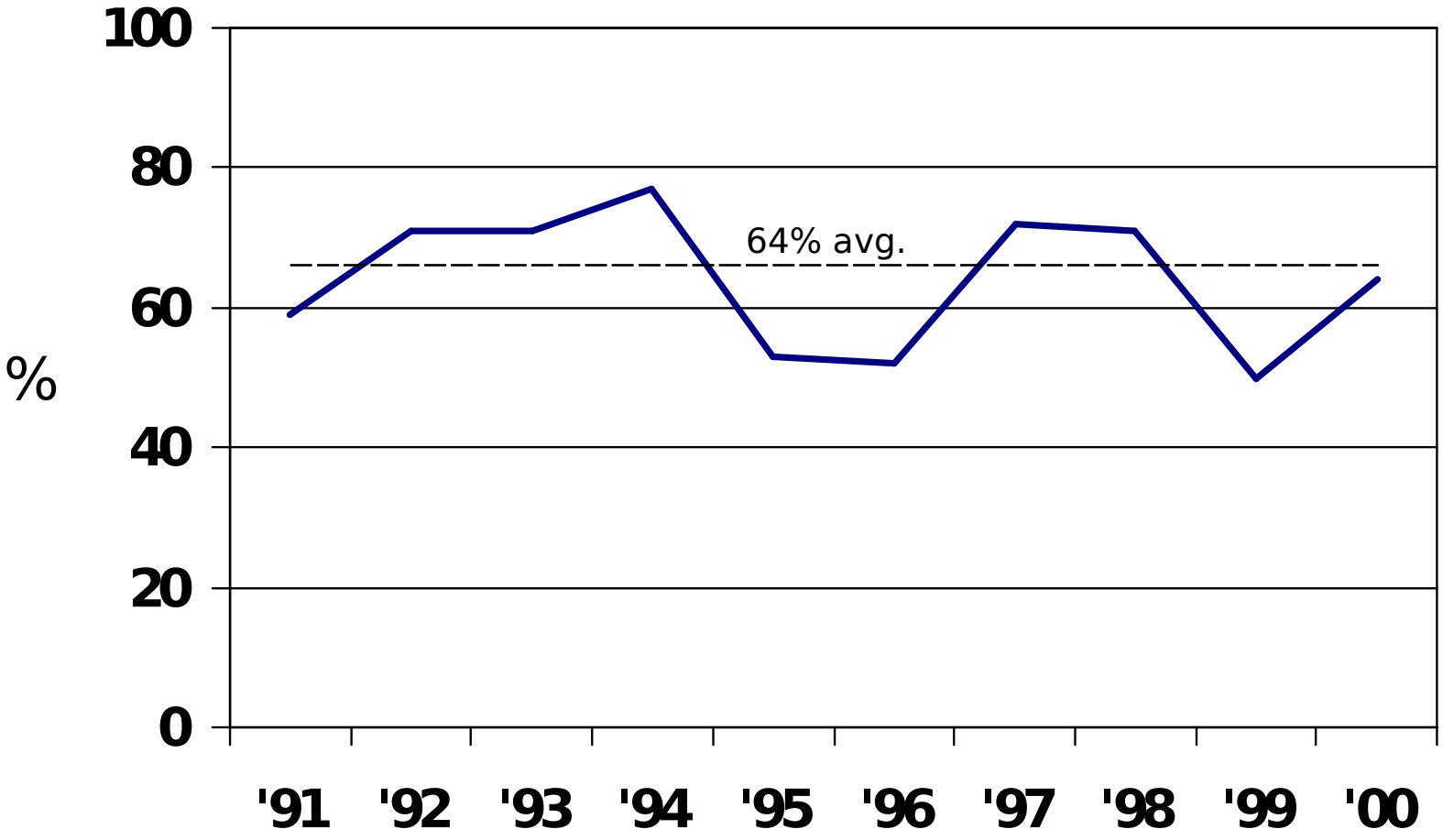
Human Factors in Context

% of Class A Flight Mishaps Due to Human Factors



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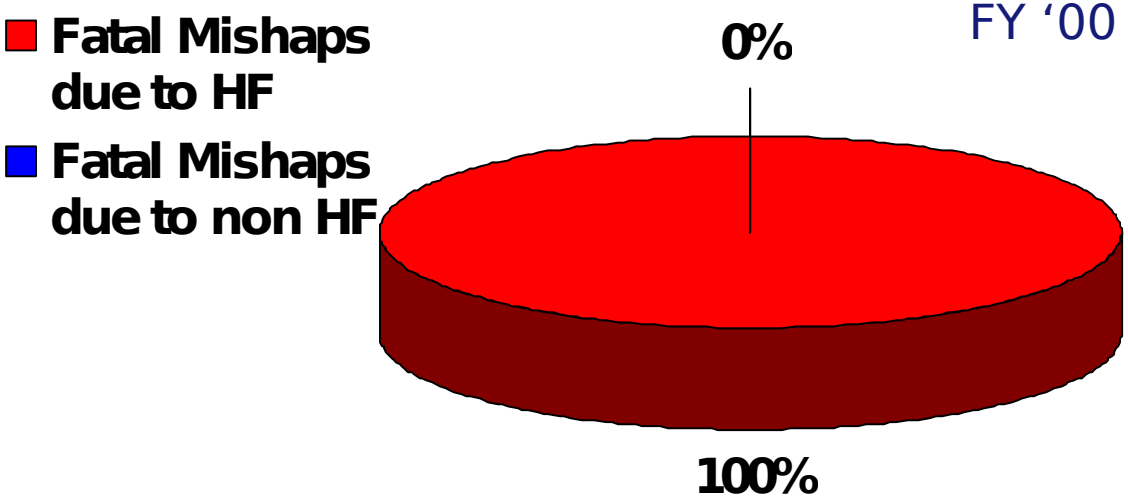
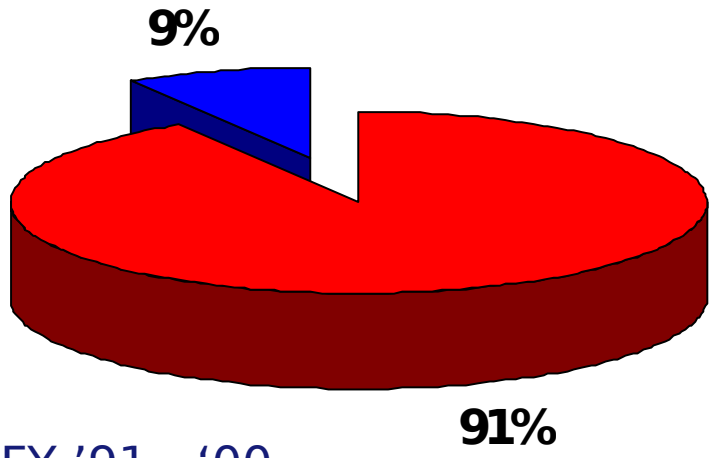
Human Factors in Context:

HF as % of Fatal Mishaps

5/5 Fatal Mishaps due to HF



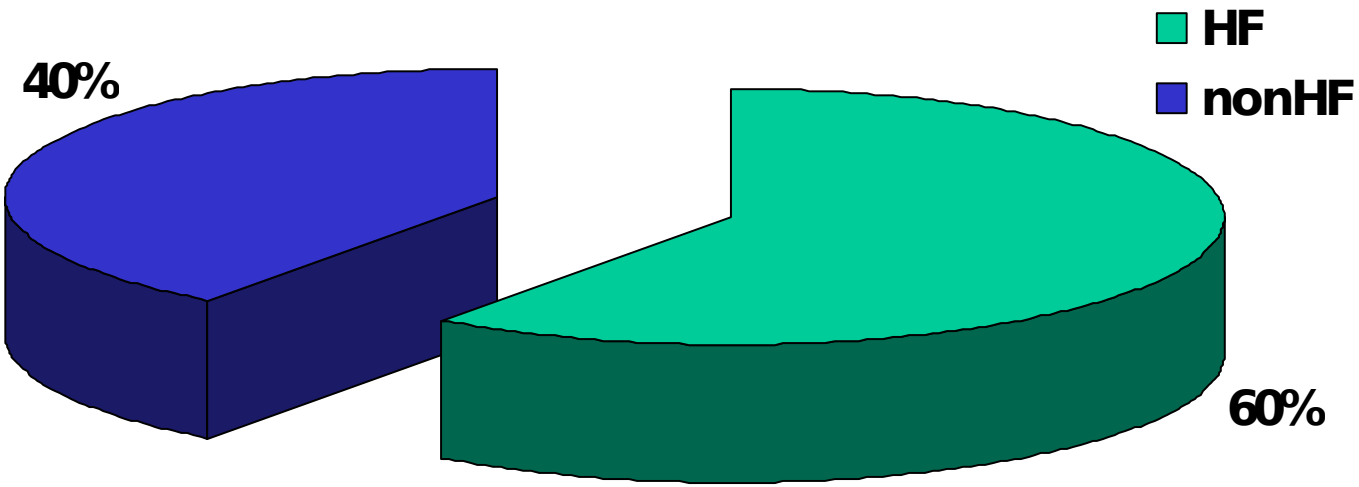


Over 90% of fatal aviation mishaps in the past 10 years due to Human Factors

[84 out of 92 fatal mishaps]

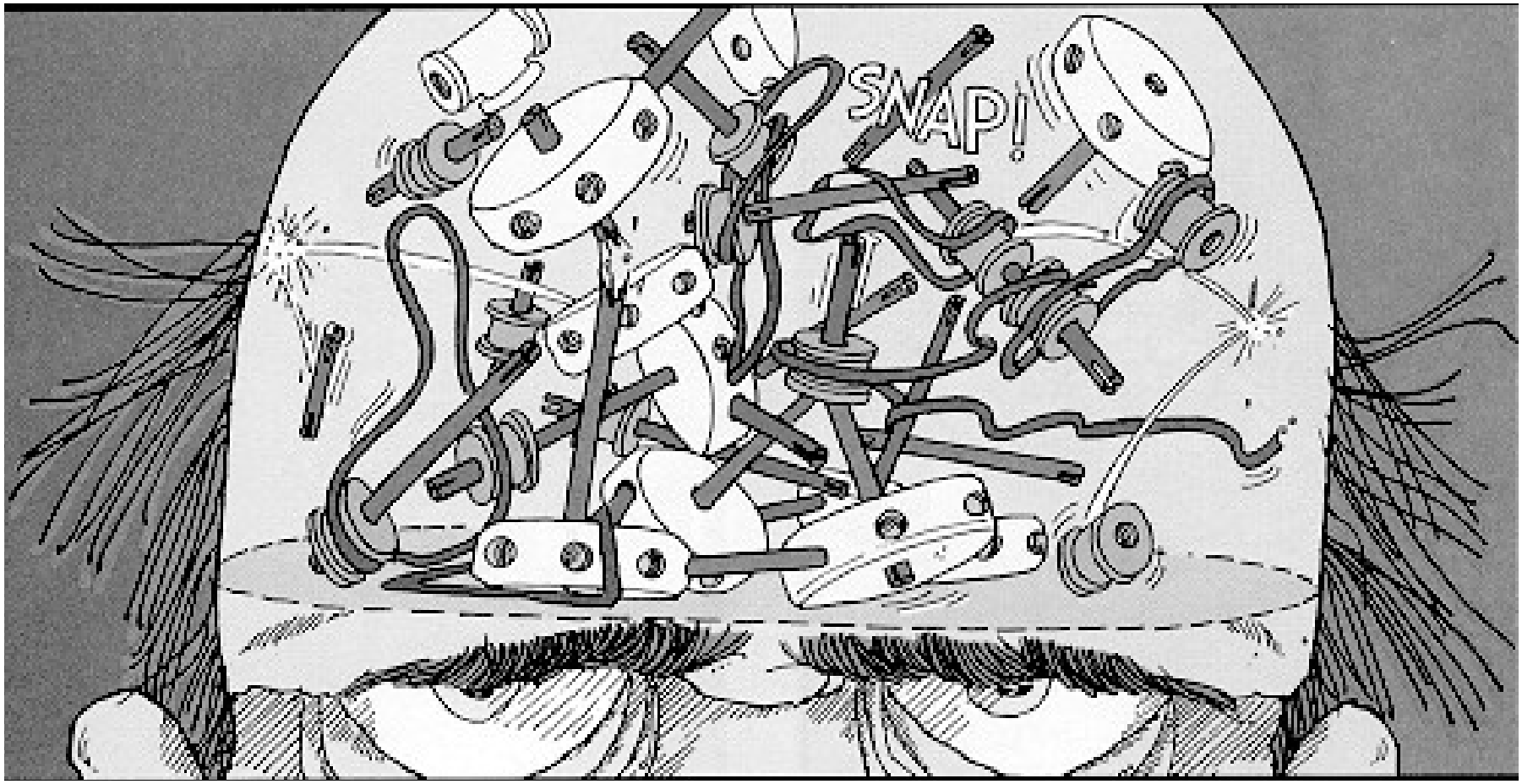
Human Factors in Context:

Cost of HF Mishaps



Cost of HF Mishaps – FY 00: **$160,755,978.0**

Total Cost of FY 00 Class A Mishaps: $267,594,896.00



BRAIN PAIN?

TAKE A BREAK!

Human Error Models for Investigation and Analysis

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Human Error Models for Investigation and Analysis

- **Knowledge and Error Flow From the Same Sources; Only Success Can Tell the One From the Other.**
- **Performance That Is Later Tagged “Human Error” Is Done So in Hindsight and Is Dependent on the Consequences of Actions.**
- **Error Is Necessary for Learning.**

Human Error

- **Human Error Occurs When Human Action Is Performed That Was Either:**
  - **Not Intended by the Actor.**
  - **Not Desired According to Some Specified Set of Rules or by Some External Observer.**
  - **Contributed to the Task or System "Going Outside Its Acceptable Limits".**
- **Intentionality and Consequence Critical to Definition**

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Human Error Perspectives

- **Phenomenological**
  - **Omission, Commission, Repetition, Substitution and Sequencing**
- **Cognitive Mechanisms**
  - **Limited Cognitive Resources (Slips/Lapses)**
- **Human – System Interaction**
  - **Skill, Rule and Knowledge Based**

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Human Error Perspectives

- **Human Communication**
  - **Interpersonal Interactions**
- **Sociocultural and Organizational**
  - **Communication, Information Flow and Organizational Structure**

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HUMAN ERROR PREVENTION

- System Definition
- System Development
- System Deployment
- System Operation and Maintenance

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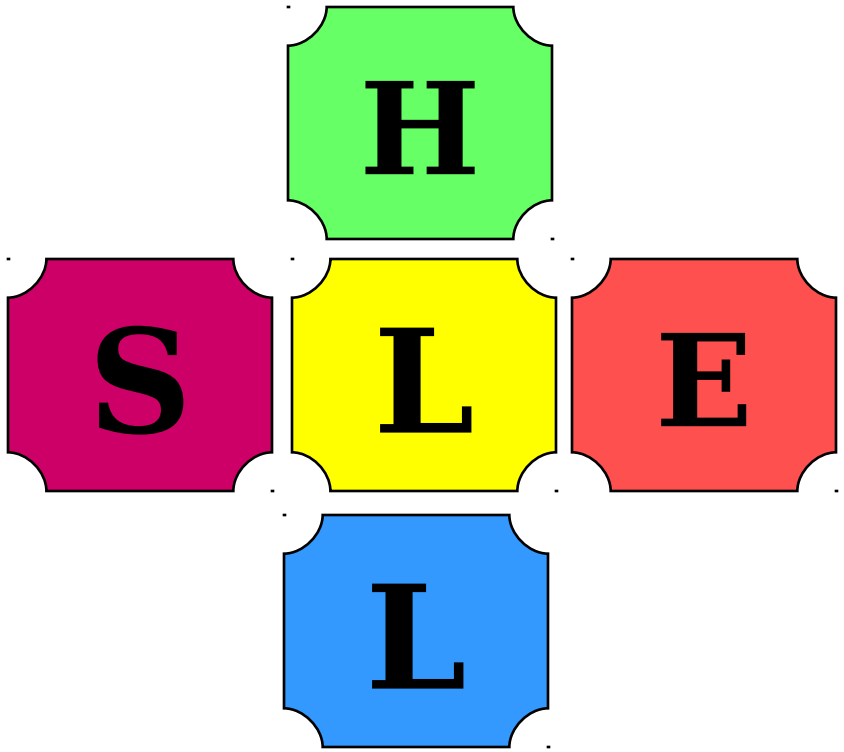
SHEL (L) Model

- **Liveware, (the person) surrounded by:**
  - **Software**
  - **Hardware**
  - **Environment**
  - **Liveware (others)**



WEAPON SYSTEM DESIGN
ORGANIZATIONAL
CLIMATE/CULTURE
MISSION
DEMANDS
CREW COORDINATION
INDIVIDU
AL
FACTORS
COMMUNICATION
OPS
ENVIRONMENT
RESOURCES:
AIRCRAFT/TIME
ENVIRONMENTAL FACTORS

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Individual and Environmental Factors

- Individual Factors Occur
- Knowledge, Rule and Skill Based
- Individual Factors Influenced By Environment
- Environmental Factors Create Both Barriers and Defenses

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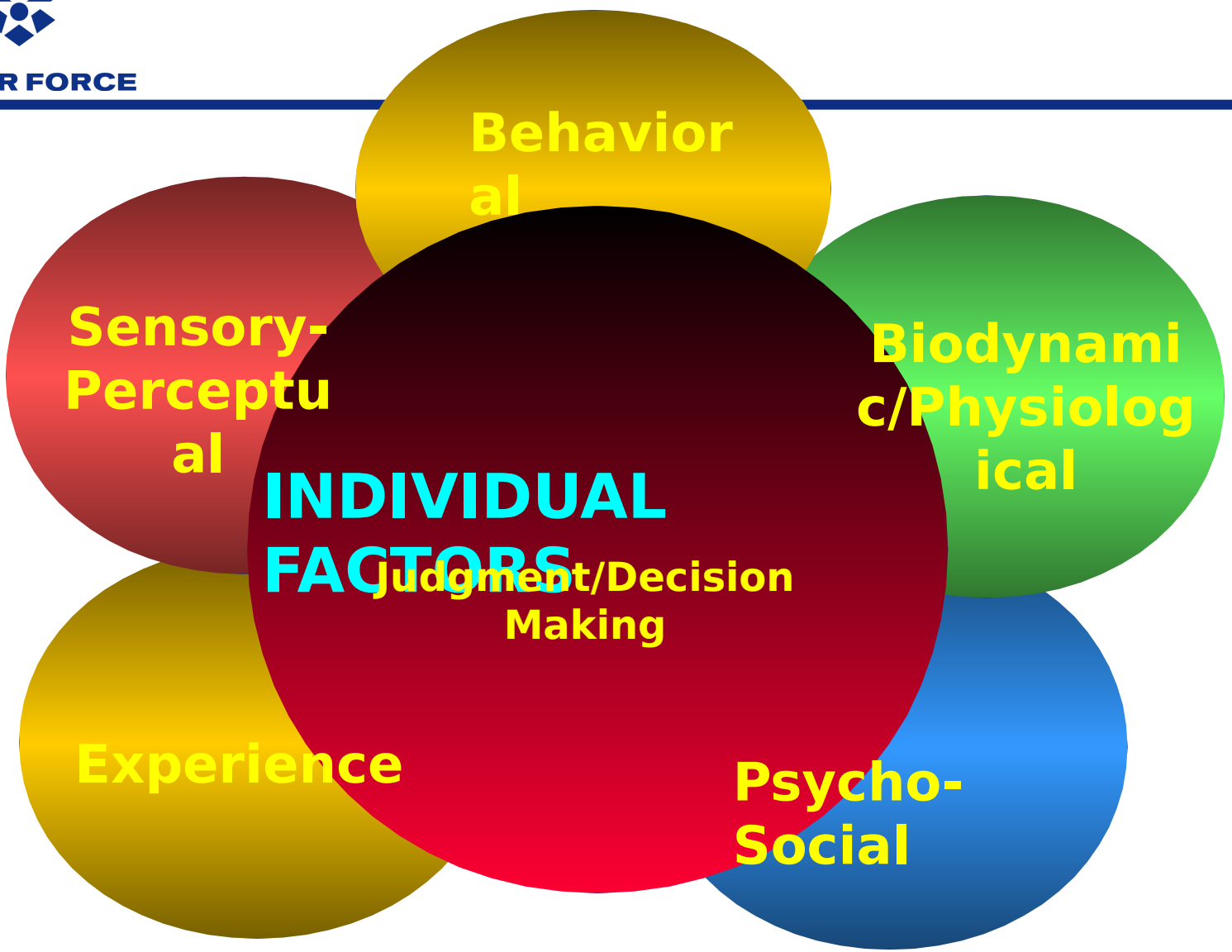
Human Error Paradox

- **Both Inexperience and High Levels of Proficiency can Lead to Human Attention Errors.**


Behavioral
Sensory-Perceptual
Biodynamic/Physiological
INDIVIDUAL FACTORS
Judgment/Decision Making
Experience
Psycho-Social

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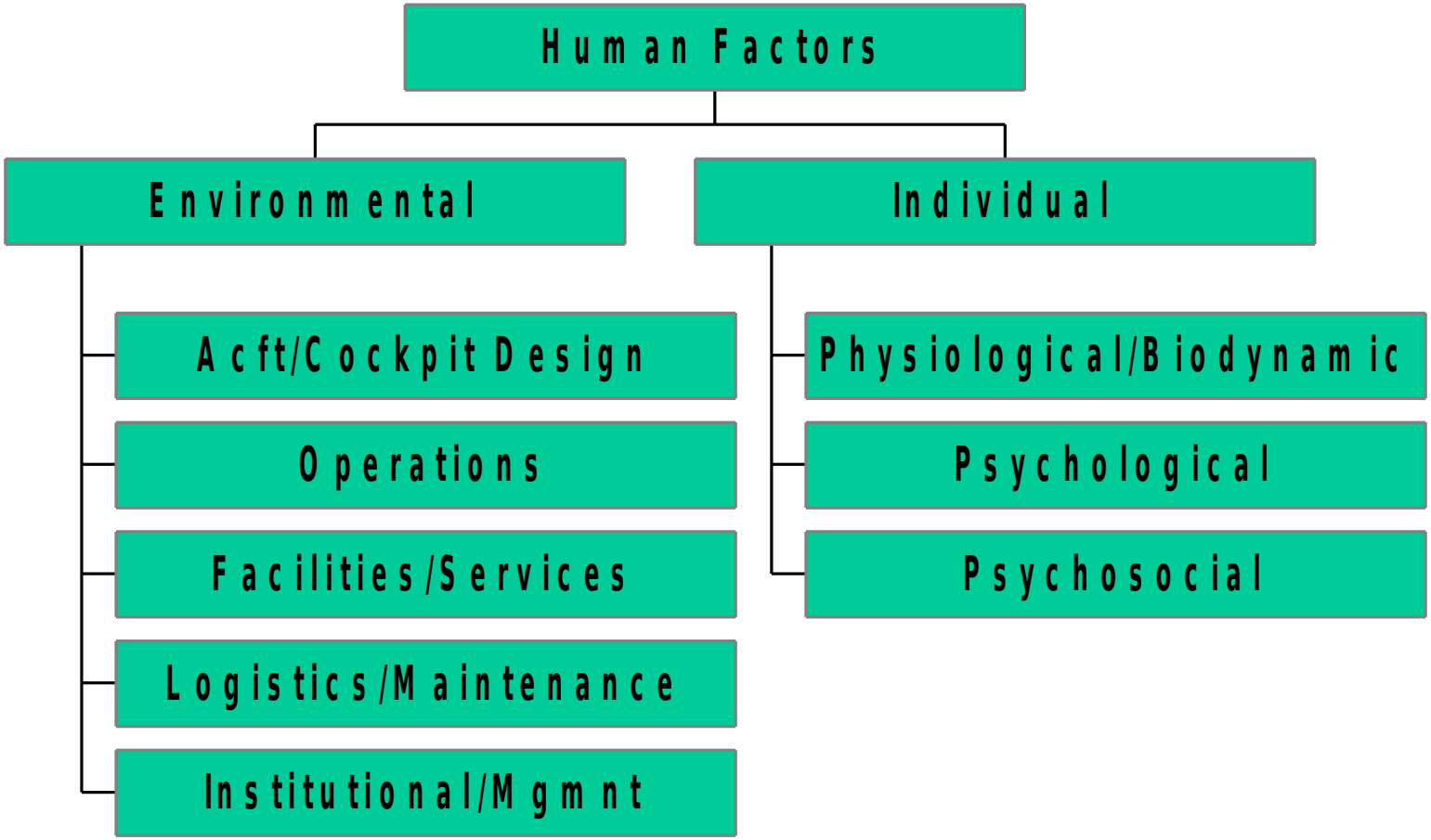
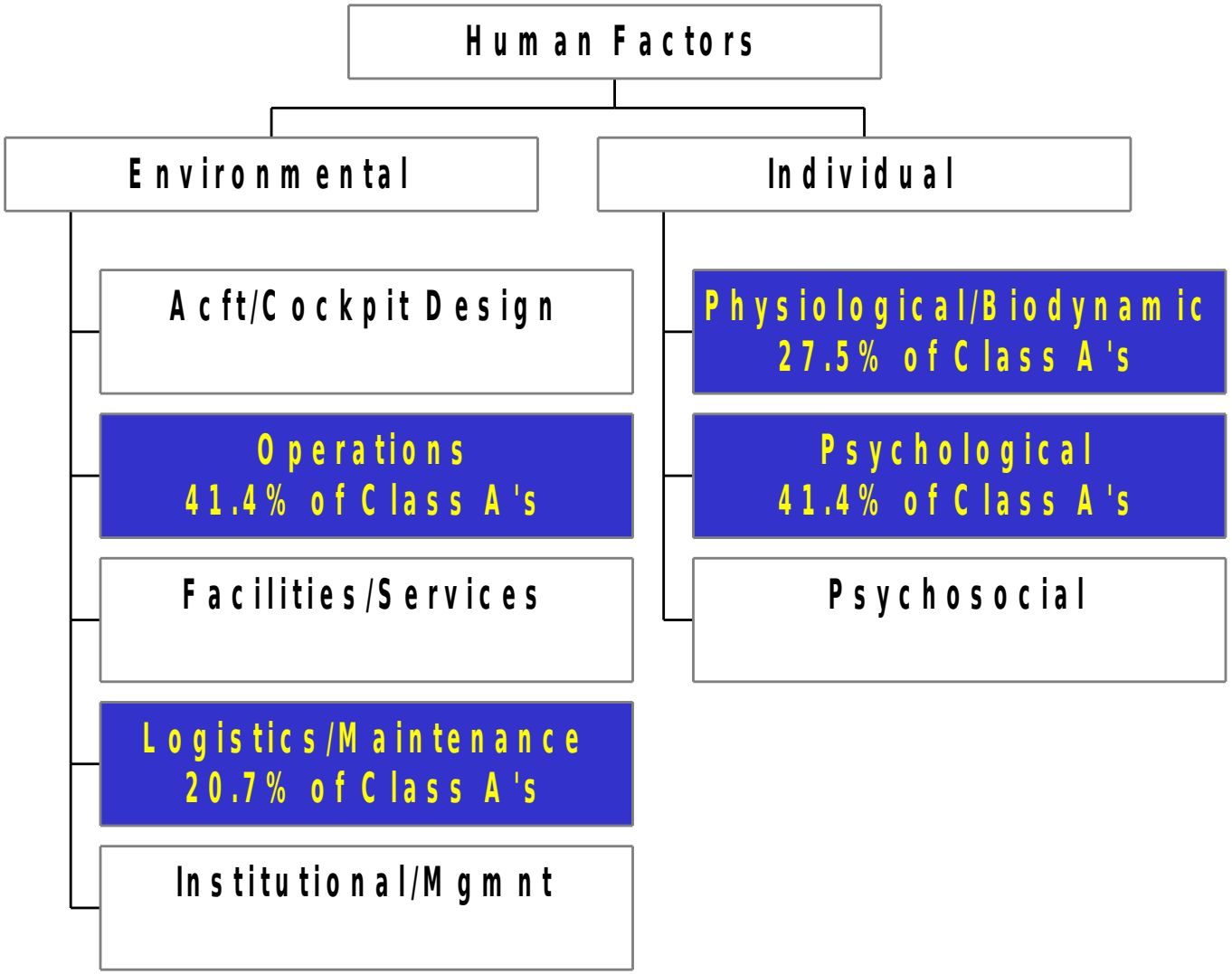
Human Factors Taxonomy



HF Components: All Class A's



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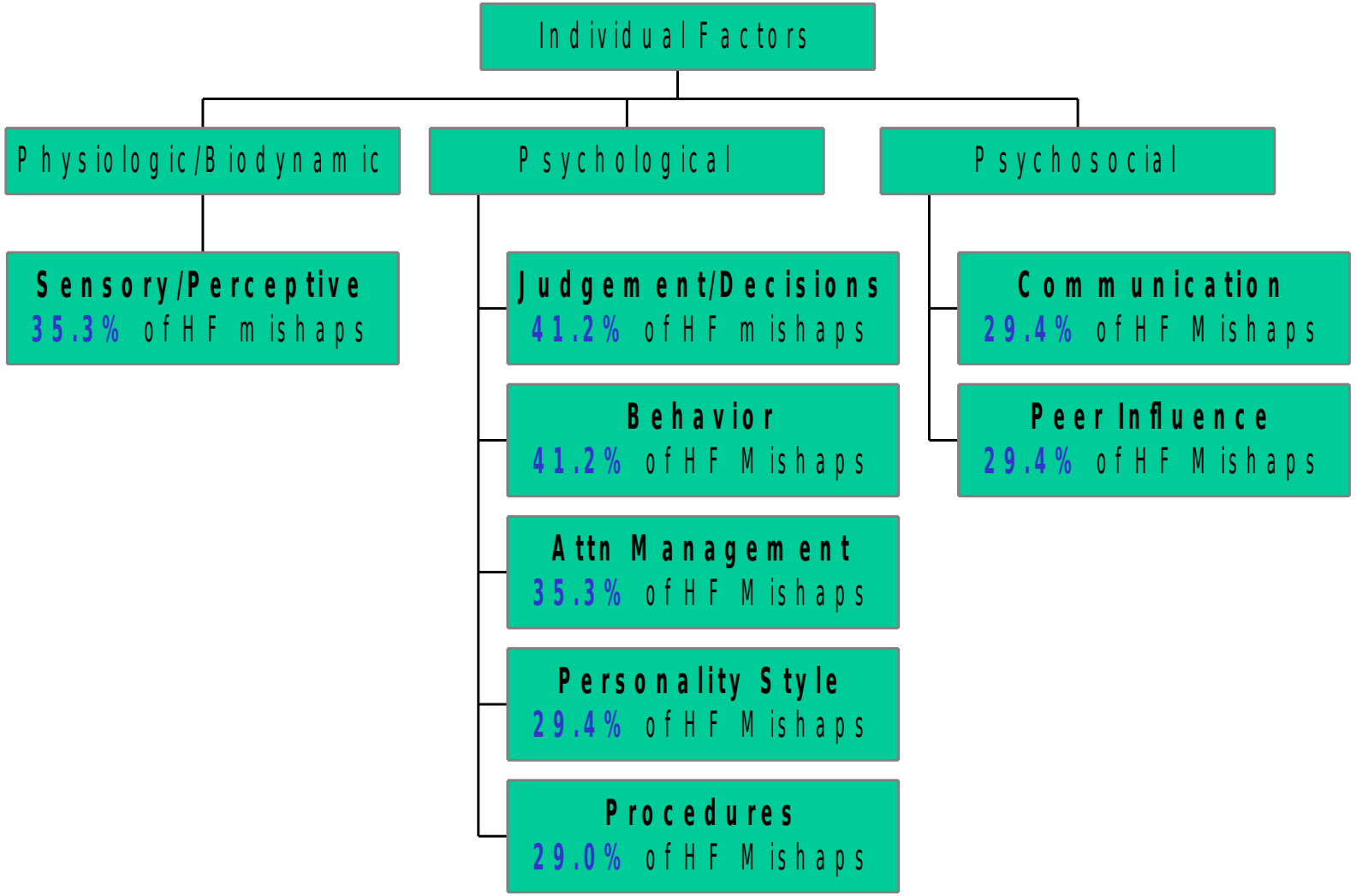
HF Mishap Breakdown: Individual Factors



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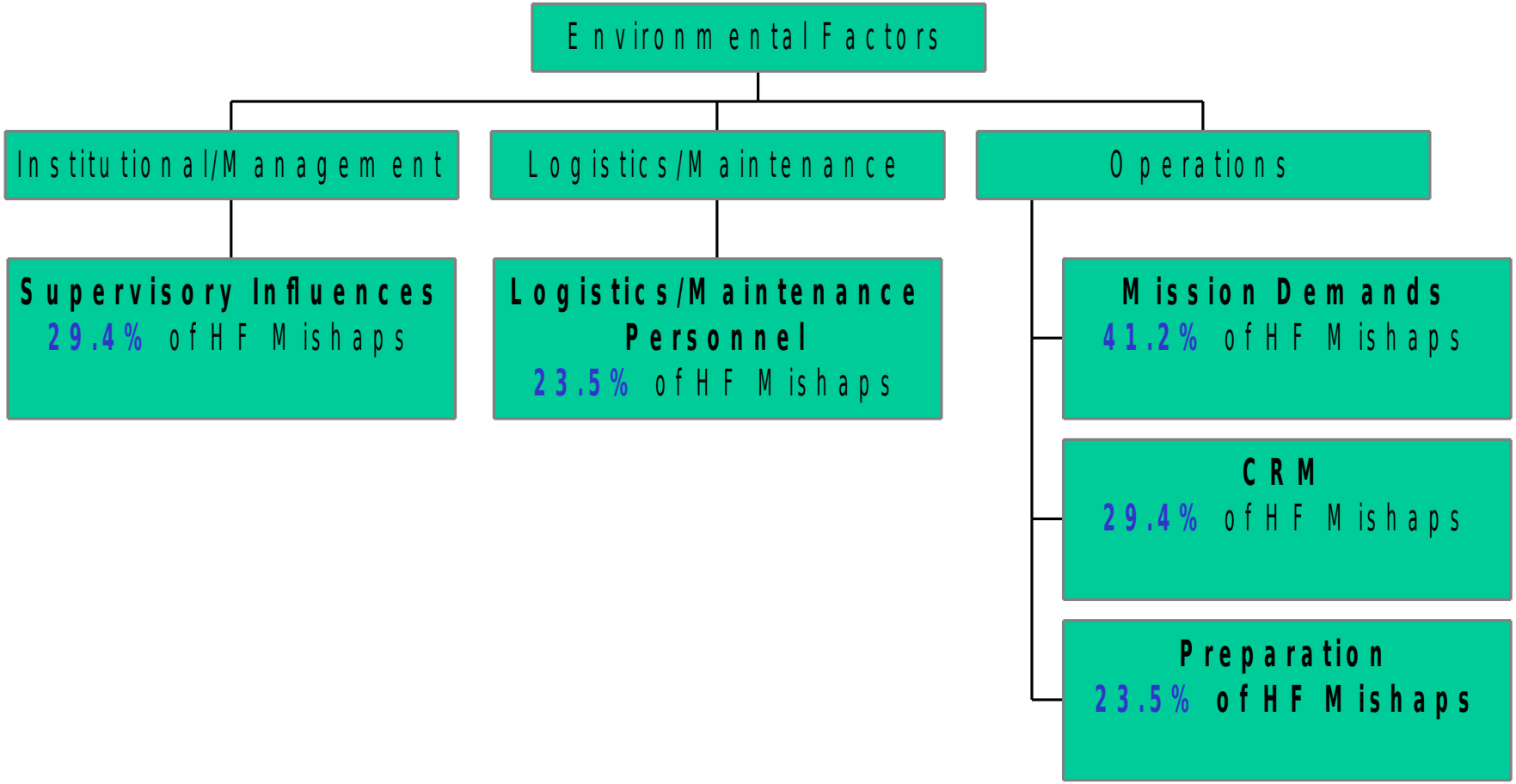
HF Mishap Breakdown: Environmental Factors



Its Application Time

- **Where Do I Start?**
- **How Cosmic Will This Stuff Get?**
- **Which Way Does the Pointy End Go?**

OR SIMPLY

- **How Do I Apply the HF Taxonomy Process to the Dynamic Environment of Operational and Operational Support Environments?**

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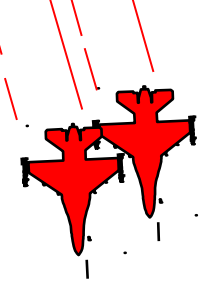
F-15 MAC Performance Factors

- Misperception
- Channelized Attention
- Selective Inattention
- Communication
- Complacency
- Task Misprioritization

“Aux, Ringo 4, Snaplock 310 for 8, 8 thousand”

T1/T2



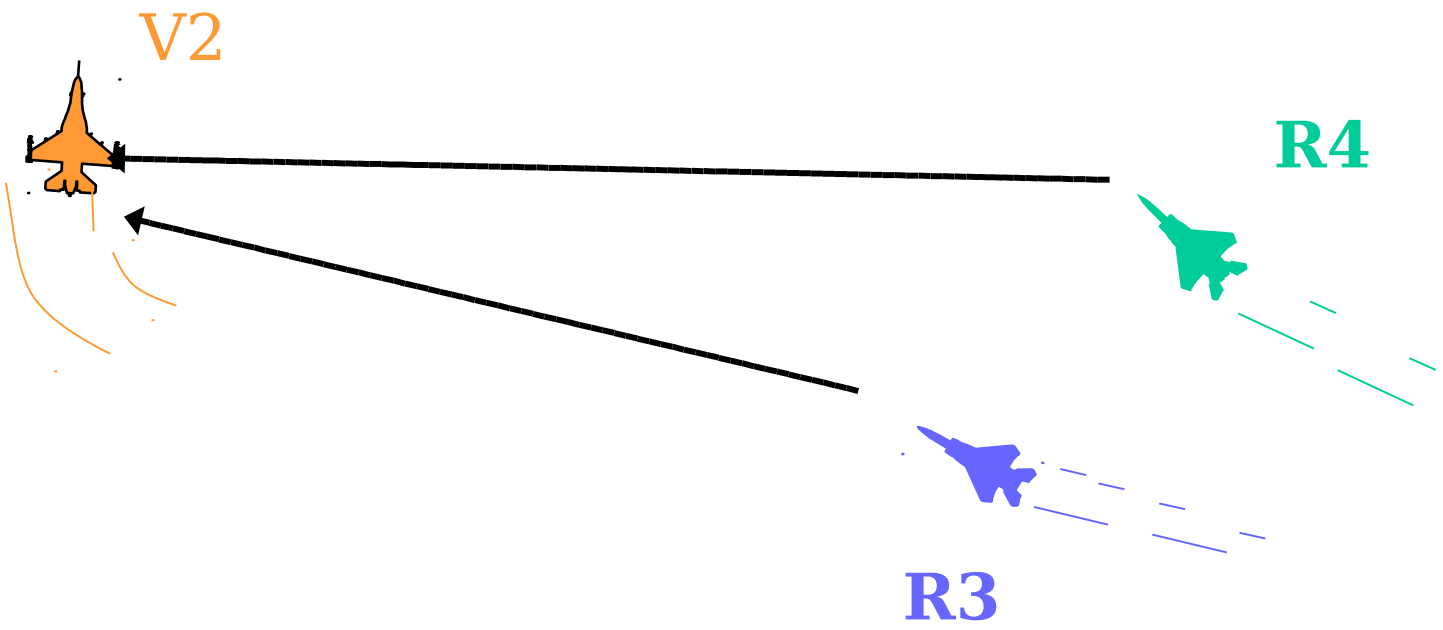
“1’s pressing, ah, 3’s pressing up there”

V2

R4 (MP2)

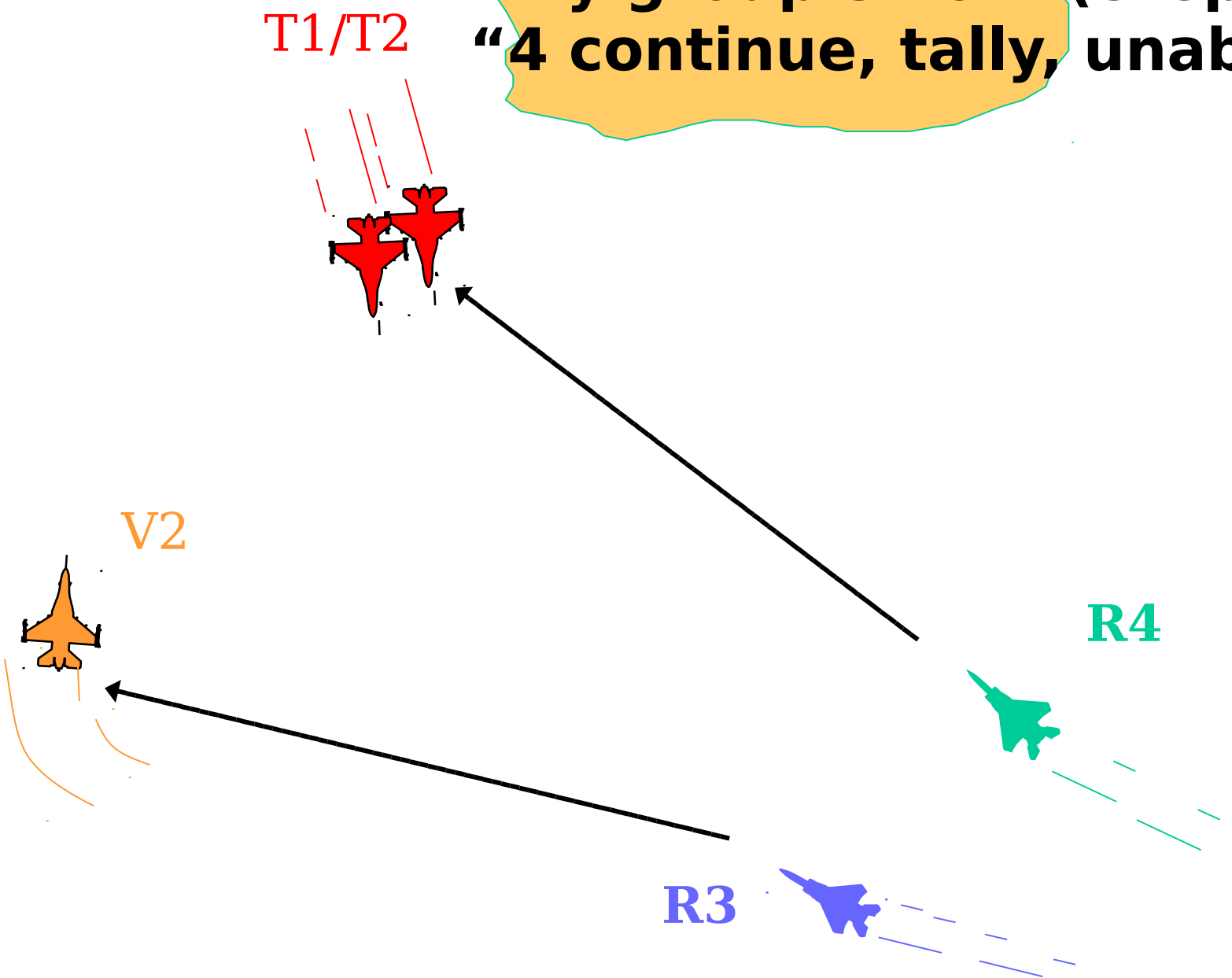
R3 (MP1)

MP1 PERCEPTION

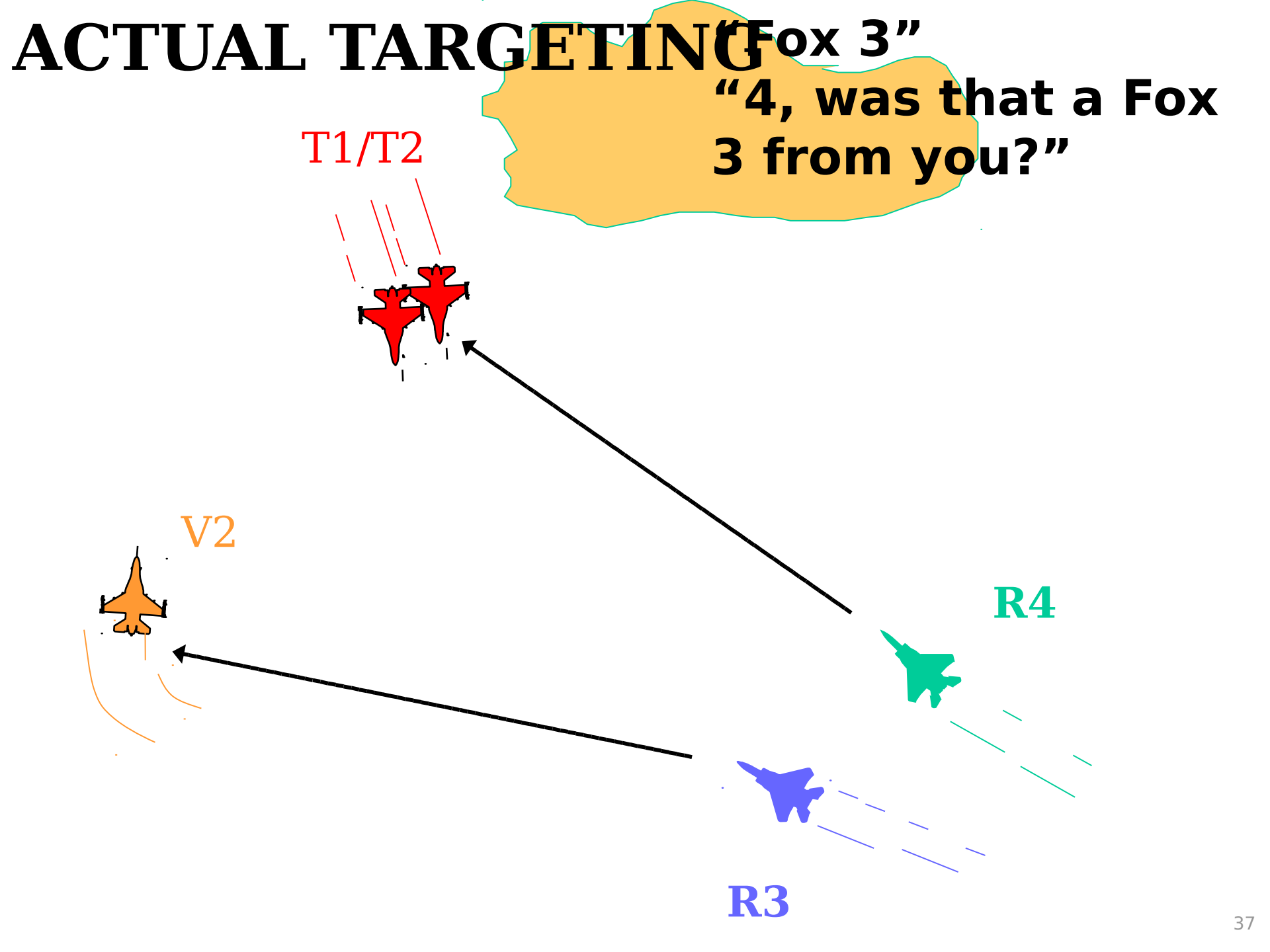


ACTUAL TARGETING

“My group’s hot” (Stepped
“4 continue, tally, unable l



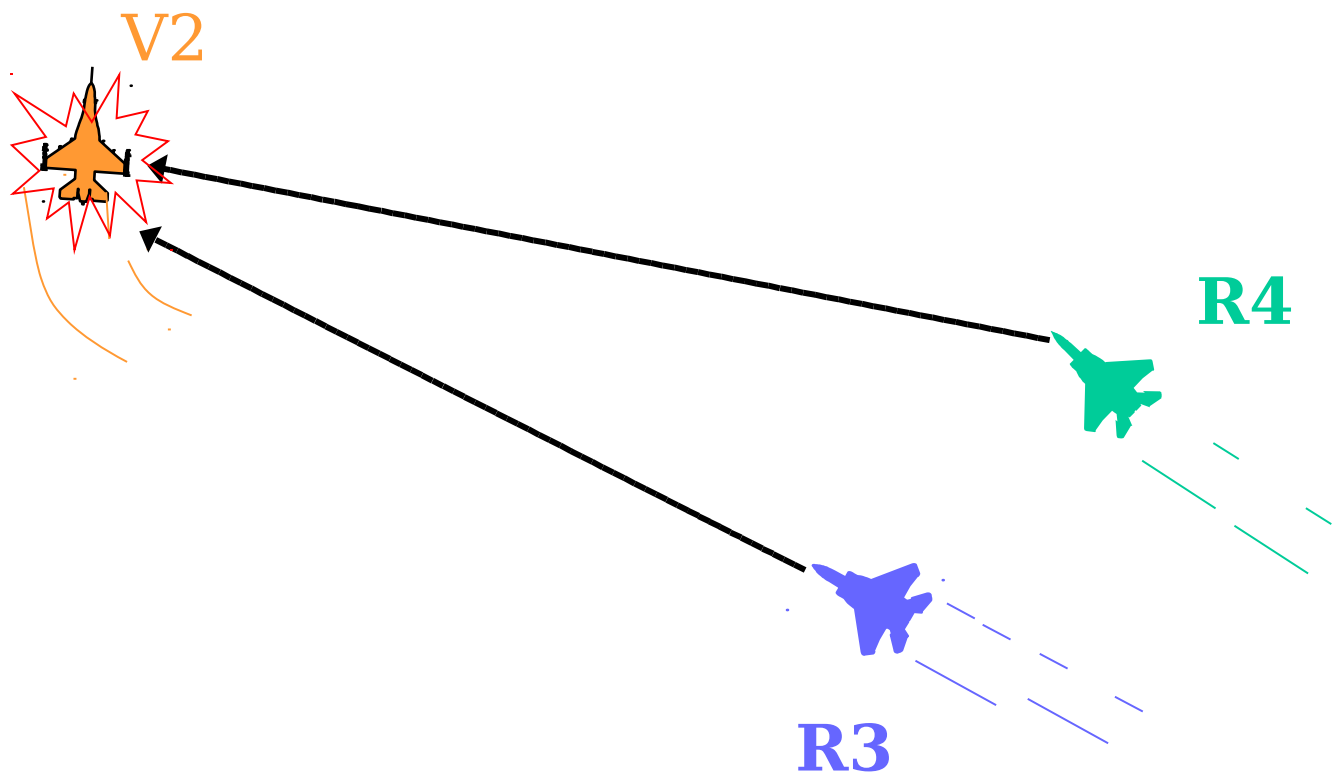
ACTUAL TARGETING



MP1 PERCEPTION

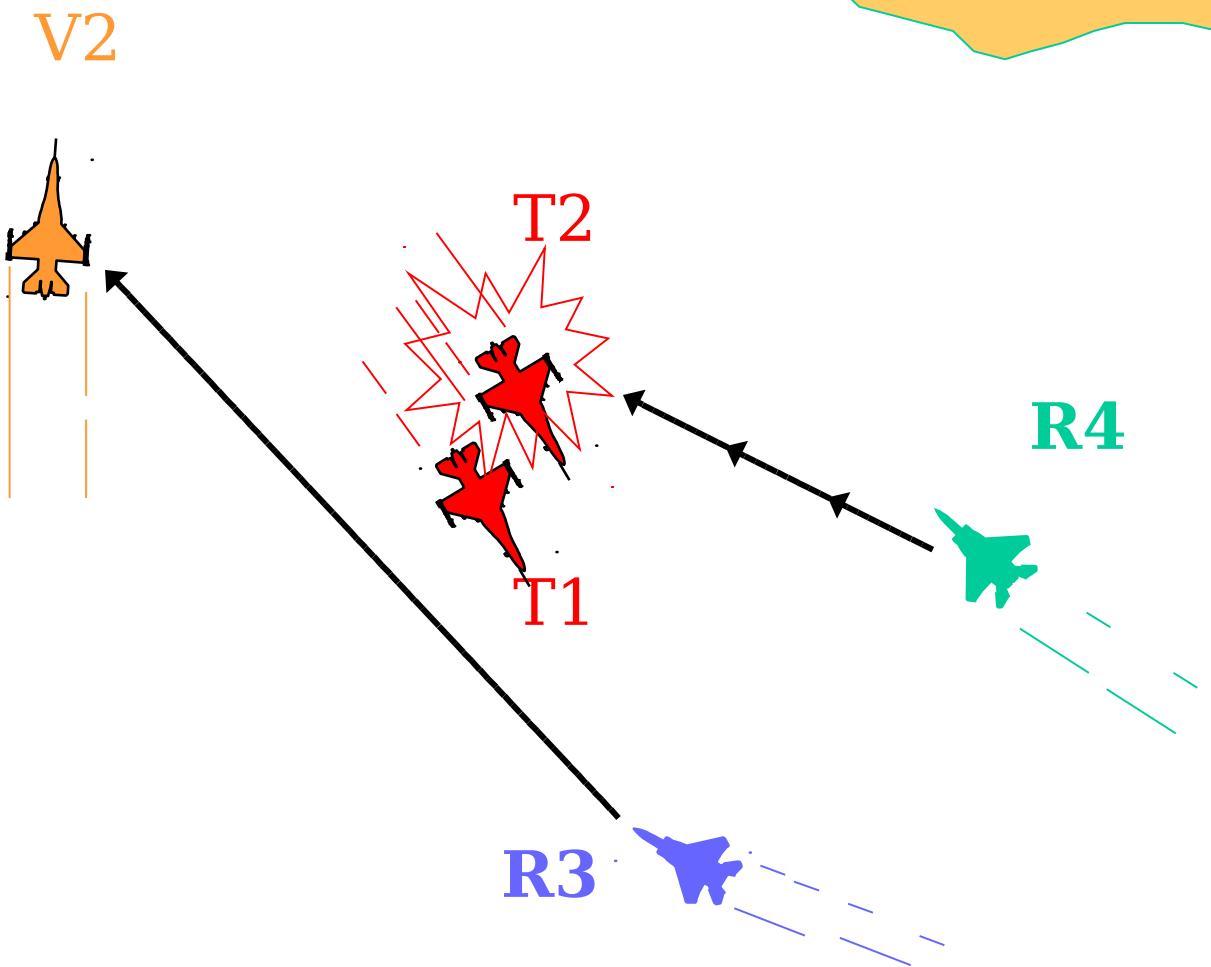
"Fox 3"

"4, was that a Fox 3 fro

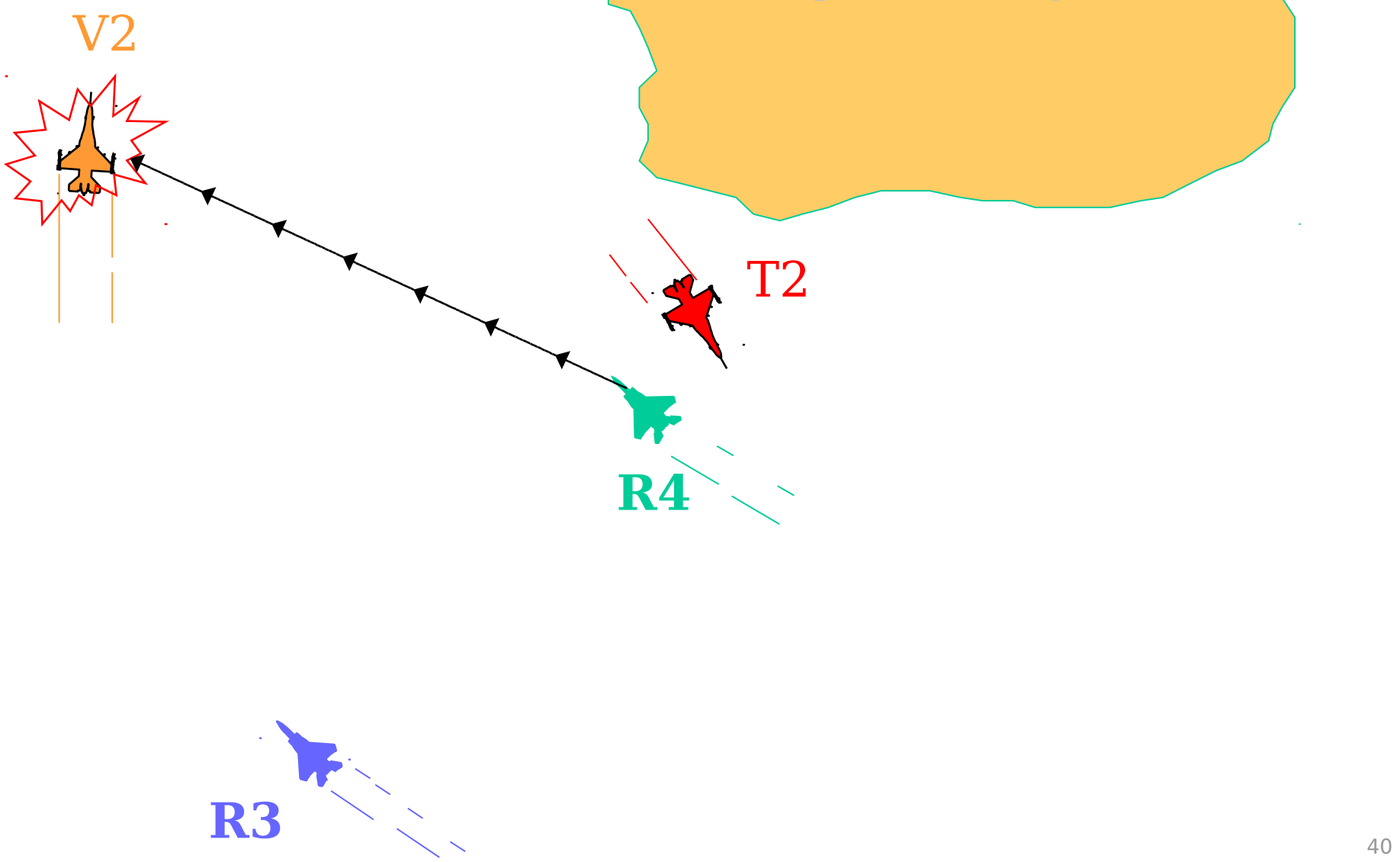


ACTUAL

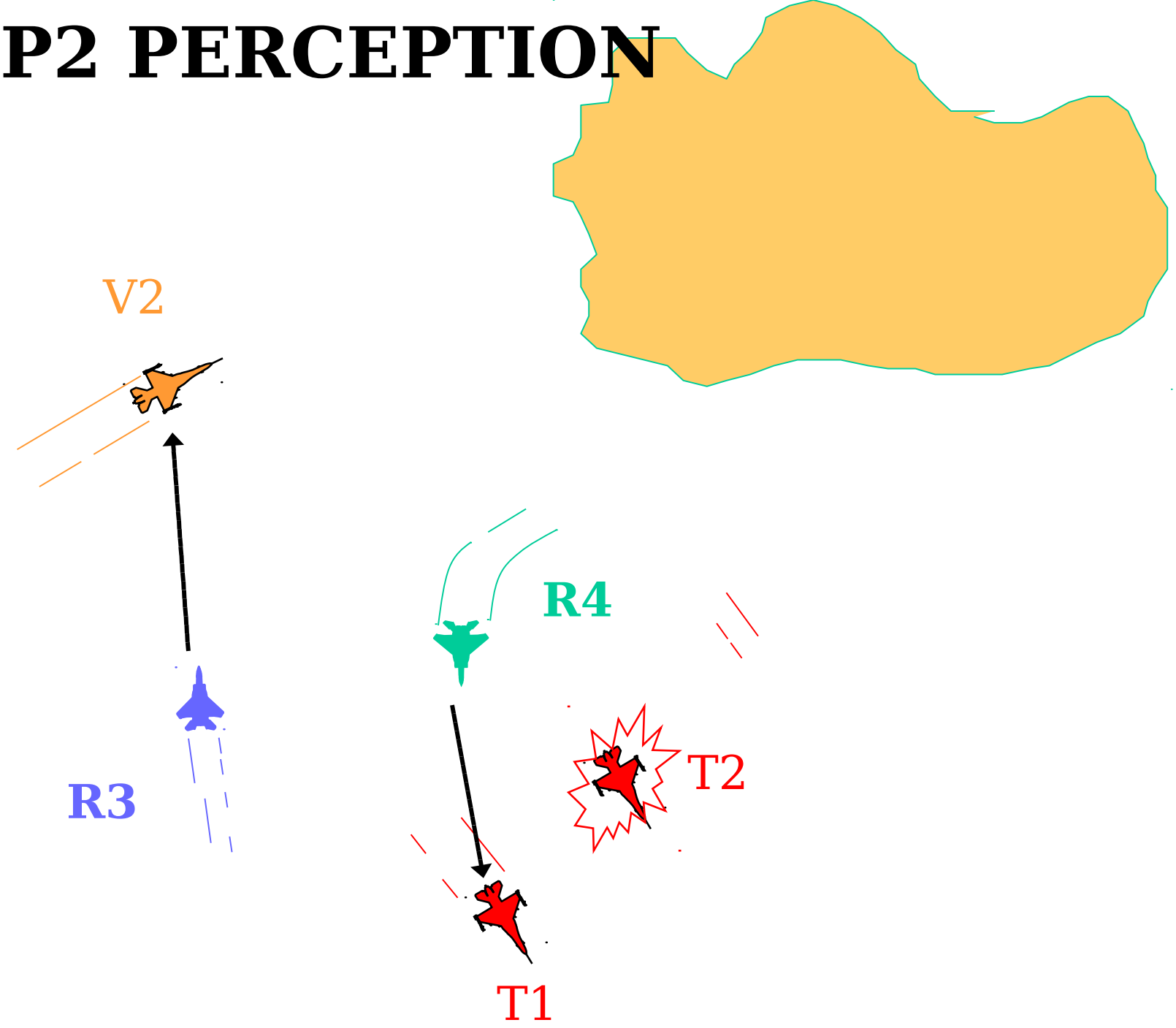
“Showtime, Fox 3 kill, single, tally two”



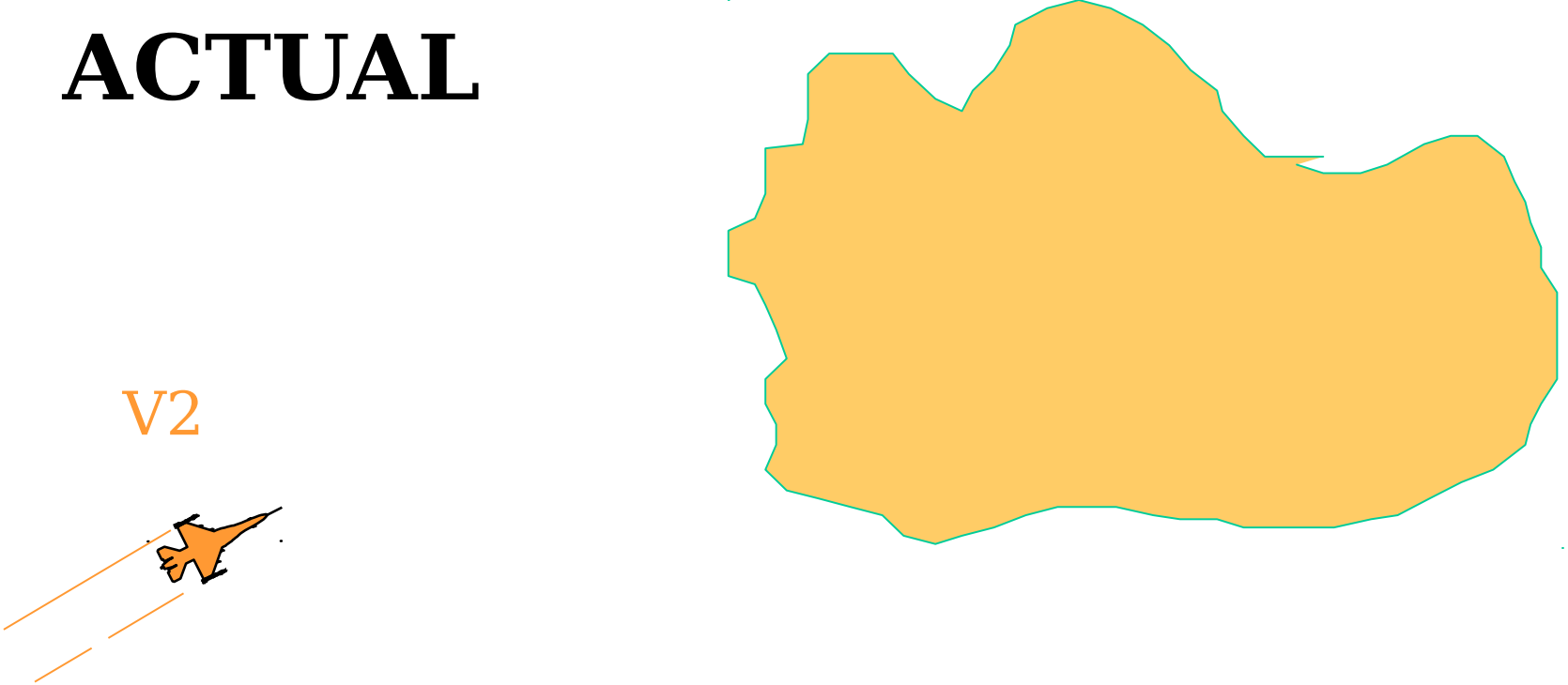
MP1 PERCEPTION



MP2 PERCEPTION



ACTUAL



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Determined as Human Factors

- Misperception
- Channelized Attention
- Selective Inattention
- Communication
- Complacency
- Task Misprioritization

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F-4F Mid Air Collision

- Misperception of Speed/Closure
- Channelized Attention
- Expectancy
- Task Misprioritization
- Course of Action

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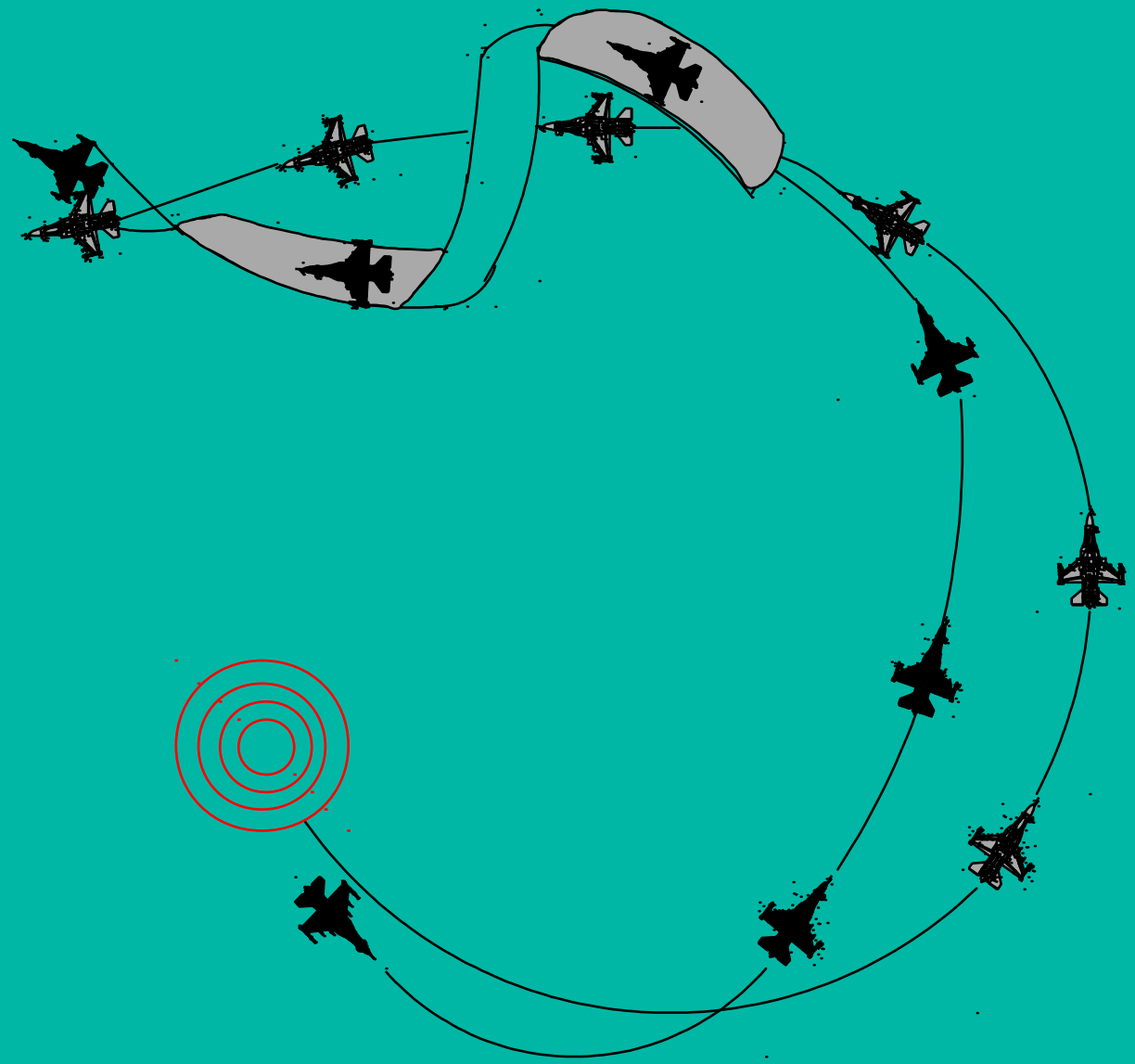
F-16 SAT Performance Factors

- MP2 Flight Discipline
- MP1 Judgment and Decision Making
- MP2 Flight Discipline



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Determined as Human Factors

- MP2 Flight Discipline
- MP1 Judgment and Decision Making
- MP2 Flight Discipline

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F-15 MAC Performance Factors

- Training
- Communication
- Judgment and Decision
- Task Misprioritization
- Misperception of Speed and Closure

F-15 Mid Air Collision

U.S. AIR FORCE

Determined as Human Factors

- Training
- Communication
- Judgment and Decision
- Task Misprioritization
- Misperception of Speed and Closure

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F-15 Type II SDO Performance Factors

- Channelized Attention
- Distraction
- Cognitive Task Oversaturation
- Type II Disorientation

TREES

U.S. AIR FORCE

Determined as Human Factors

- Channelized Attention
- Distraction
- Cognitive Task Oversaturation
- Type II Disorientation

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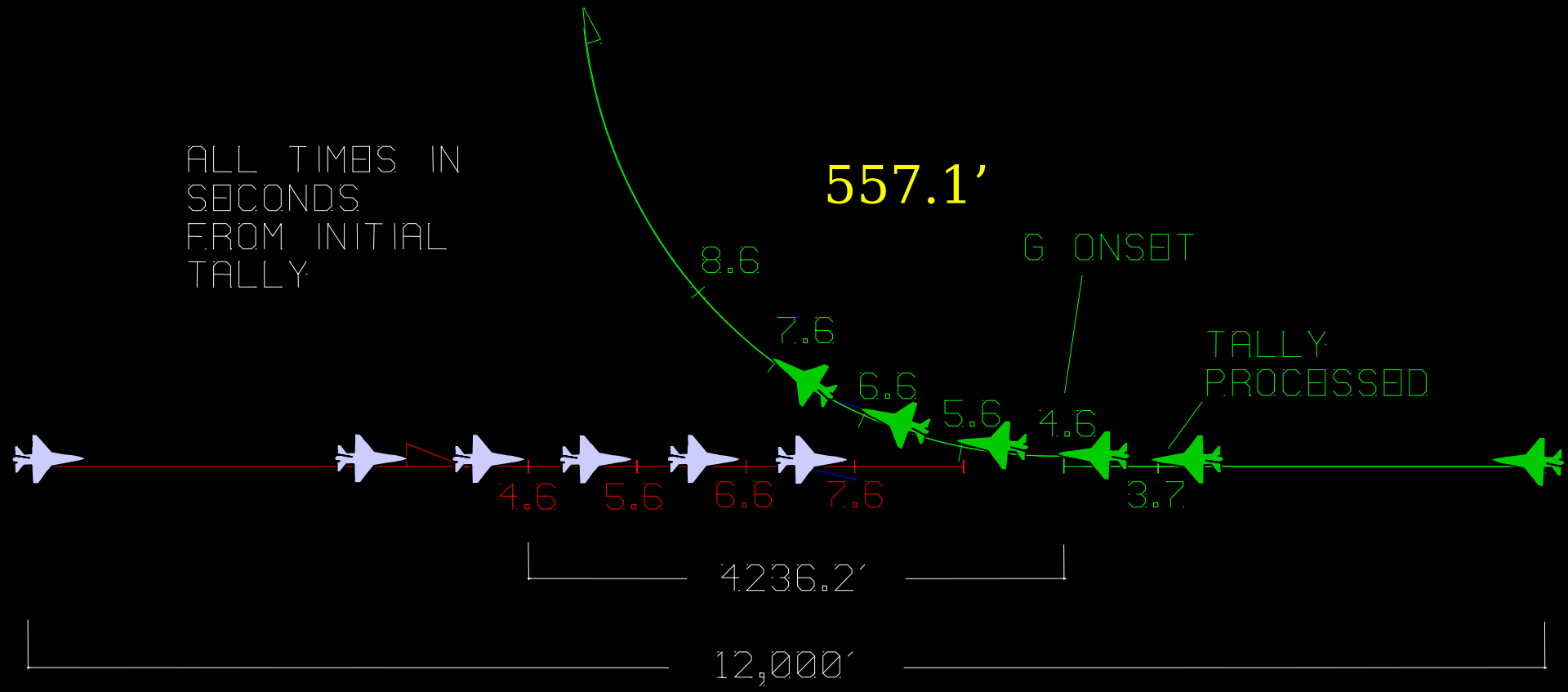
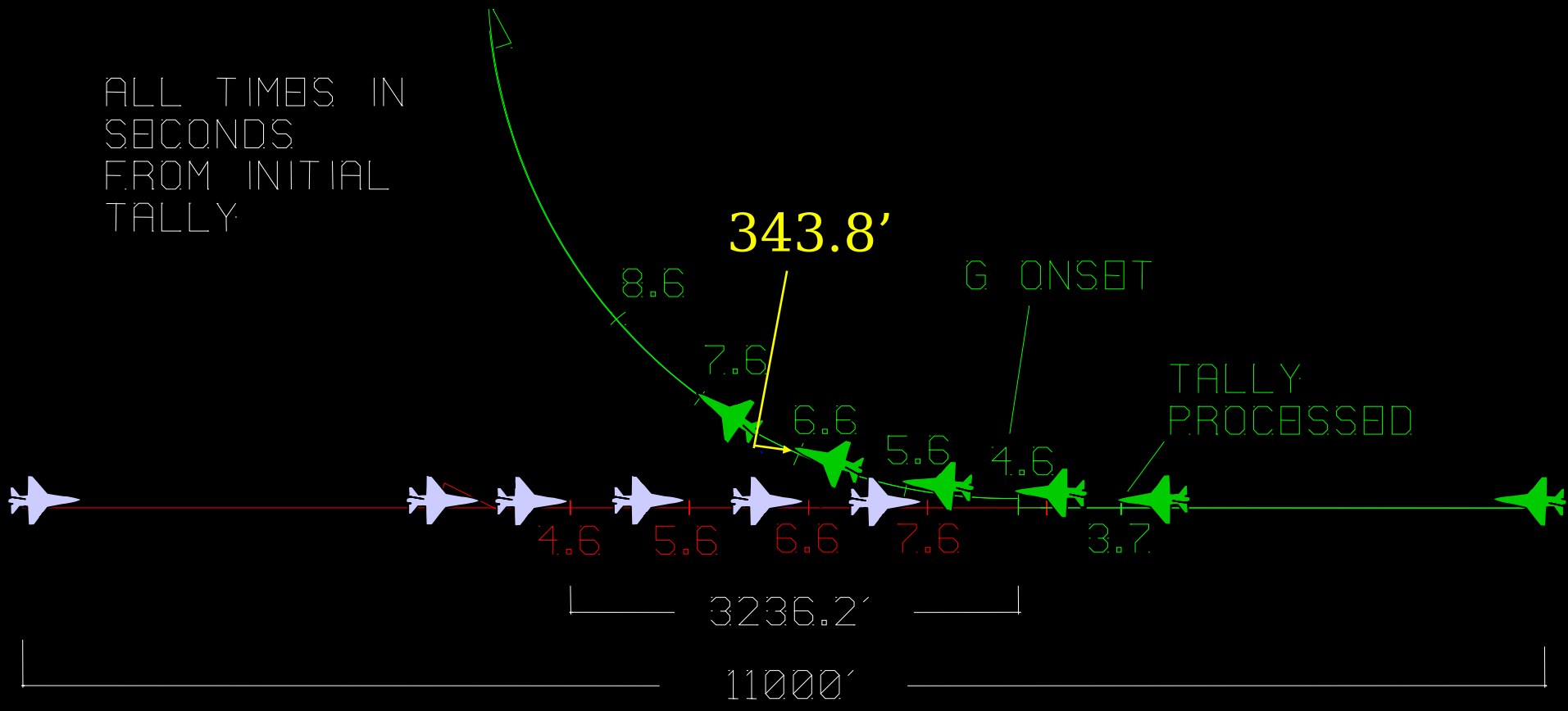
F-16 MAC Performance Factors

- Misperception of Distance, Altitude, Separation
- Expectancy
- Channelized Attention (MP1)
- Perceived Upgrade Pressure (MP1)
- Misinterpretation of Radar Targeting (MP1)
- Confusion(MP1)
- Course of Action Selected (MP1)
- Task Misprioritization (MP2)

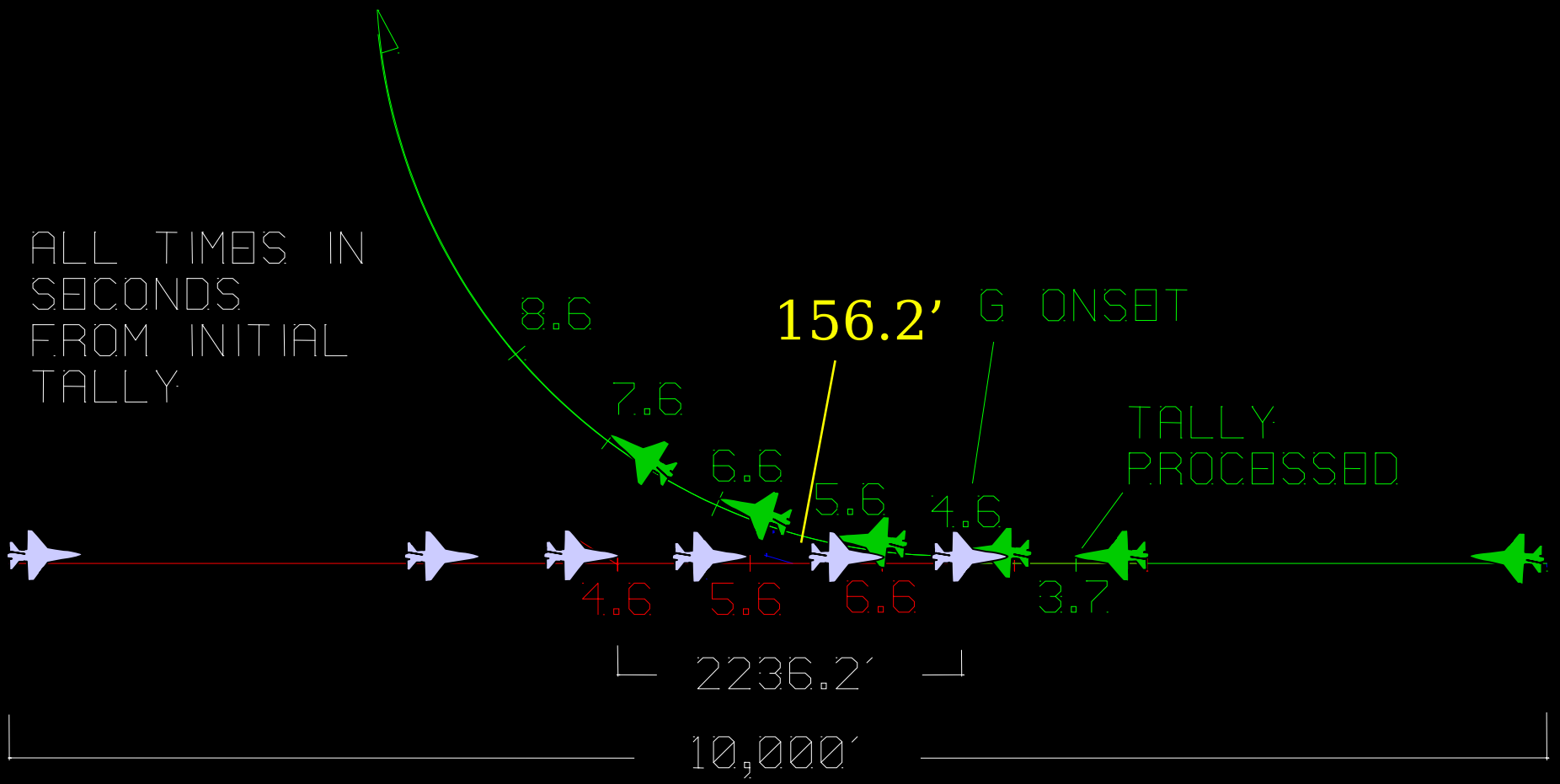
TALLY AT 12,000’



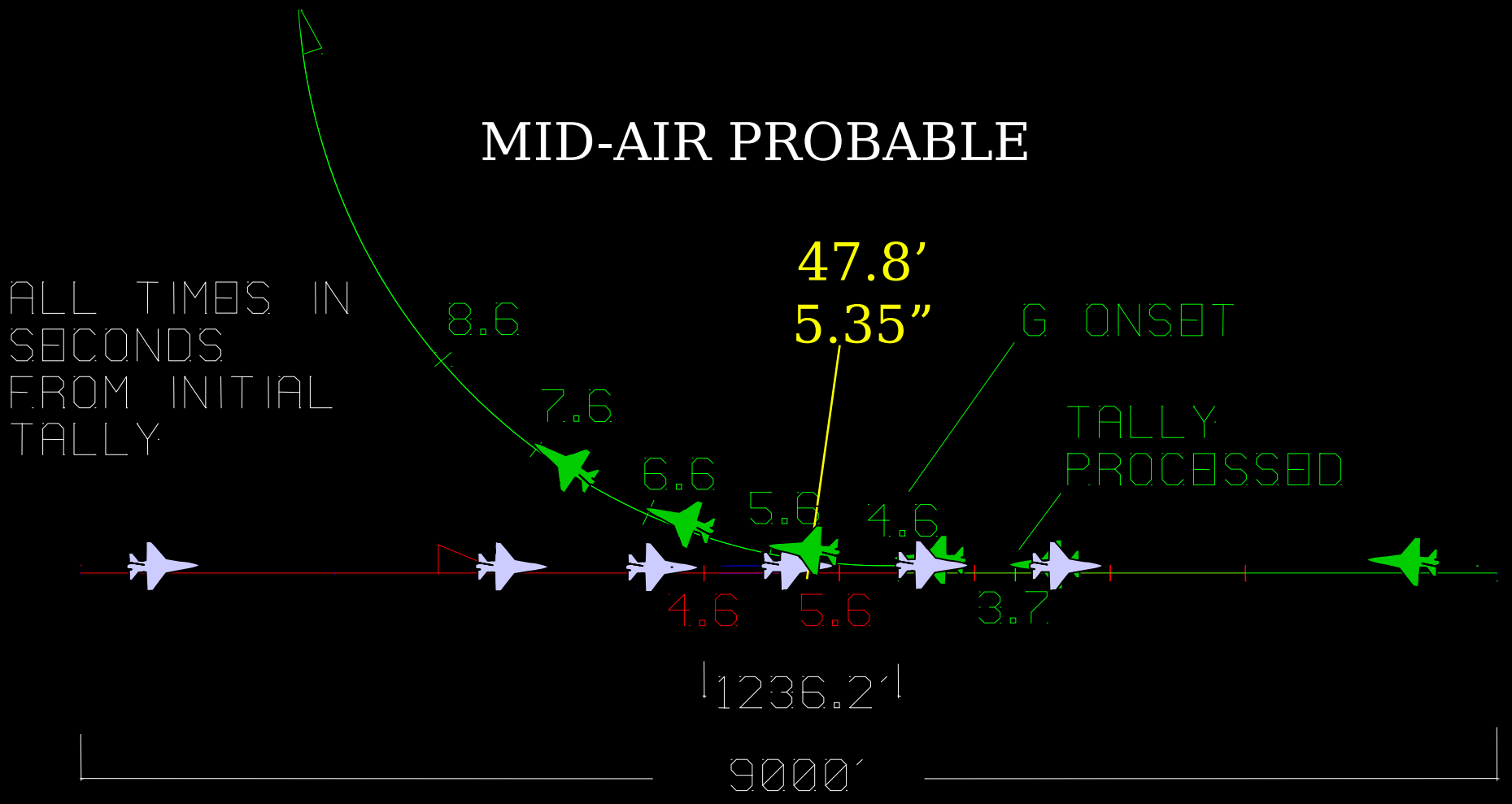
TALLY AT 11,000’



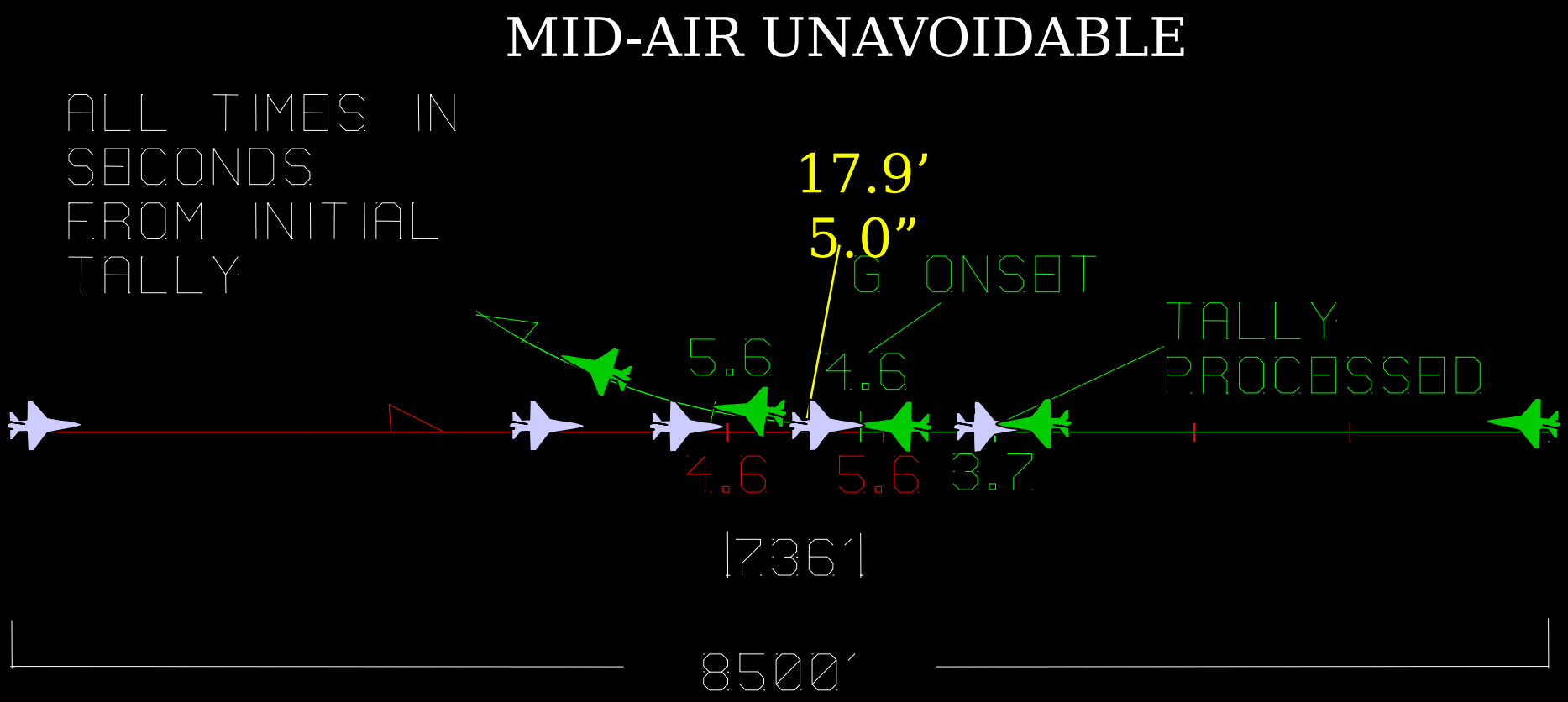
TALLY AT 10,000’



TALLY AT 9,000’



TALLY AT 8500’



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Determined as Human Factors

- Misperception of Distance, Altitude, Separation
- Expectancy
- Channelized Attention (MP1)
- Perceived Upgrade Pressure (MP1)
- Misinterpretation of Radar Targeting (MP1)
- Confusion(MP1)
- Course of Action Selected (MP1)
- Task Misprioritization (MP2)

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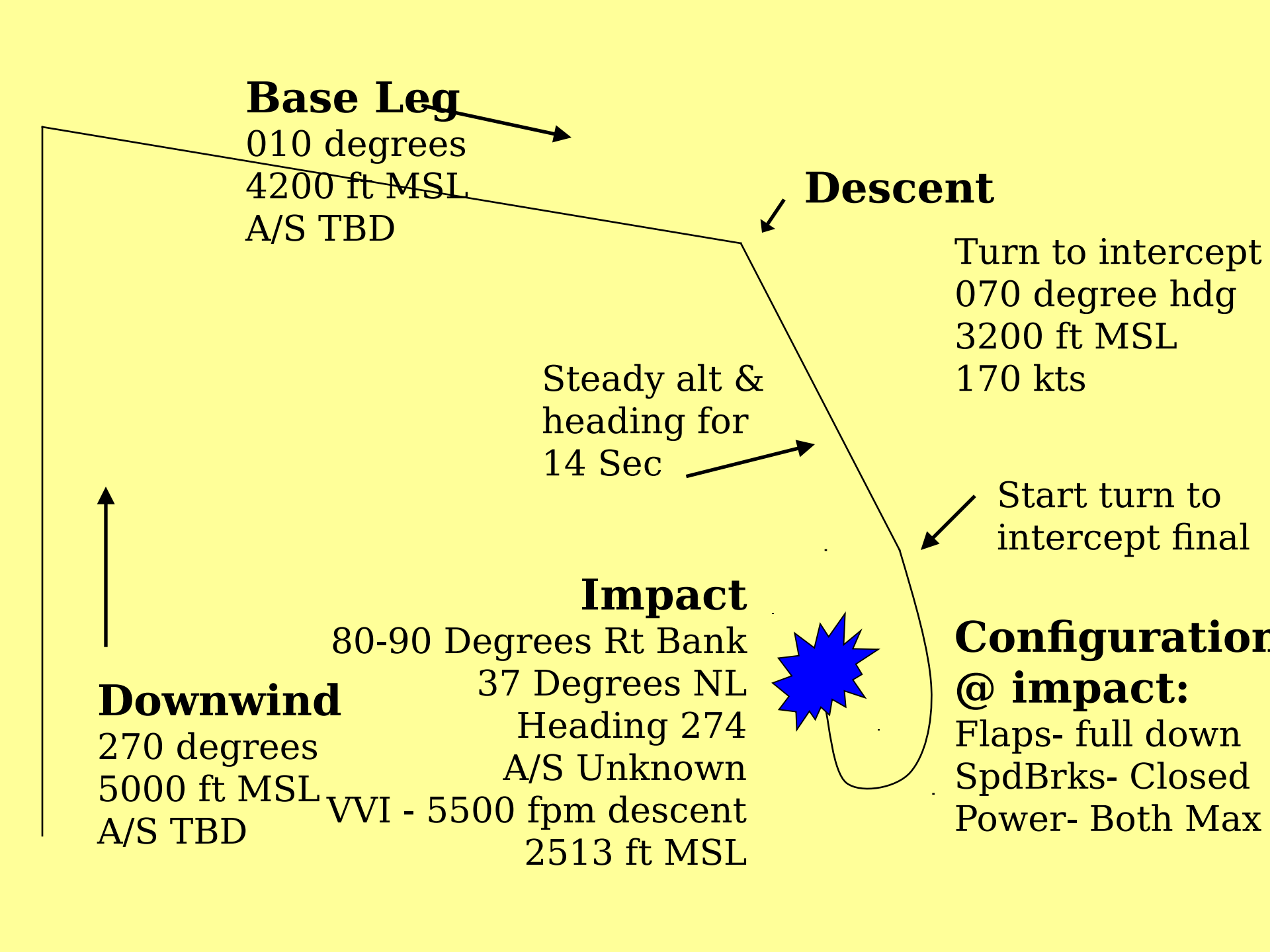
A-10 Performance Factors

- Limited night IMC proficiency
- MIP descended 380 ft below step-down, executed missed approach
- On dogleg, descent to 1000 ft below assigned altitude
- Turn to final, unrecognized overbank descent


Base Leg
010 degrees
4200 ft MSL
A/S TBD
Descent
Turn to intercept
070 degree hdg
3200 ft MSL
170 kts
Steady alt &
heading for
14 Sec
Start turn to
intercept final
Impact
80-90 Degrees Rt Bank
37 Degrees NL
Heading 274
A/S Unknown
VVI - 5500 fpm descent
2513 ft MSL
Configuration
@ impact:
Flaps- full down
SpdBrks- Closed
Power- Both Max
Downwind
270 degrees
5000 ft MSL
A/S TBD

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Determined as Human Factors

- Limited night IMC proficiency
- MIP descended 380 ft below step-down, executed missed approach
- On dogleg, descent to 1000 ft below assigned altitude
- Turn to final, unrecognized overbank descent

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F-16 Mid-Air Collision Performance Factors

- Misperception of speed and closure
- Task misprioritization
- Judgement and decision making

F-16 Midair, with NVGs

7.9 NM	*1.1 NM*	*3000 FT*	*954 FT*
T-59 Sec	T-18 Sec	T-10 Sec	T-3 Sec
371 KCAS	372 KCAS	373 KCAS	377 KCAS
Closure 640	Closure 350	Closure 190	Closure 180

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Determined as Human Factors

- Misperception of speed and closure
- Task misprioritization
- Judgement and decision making

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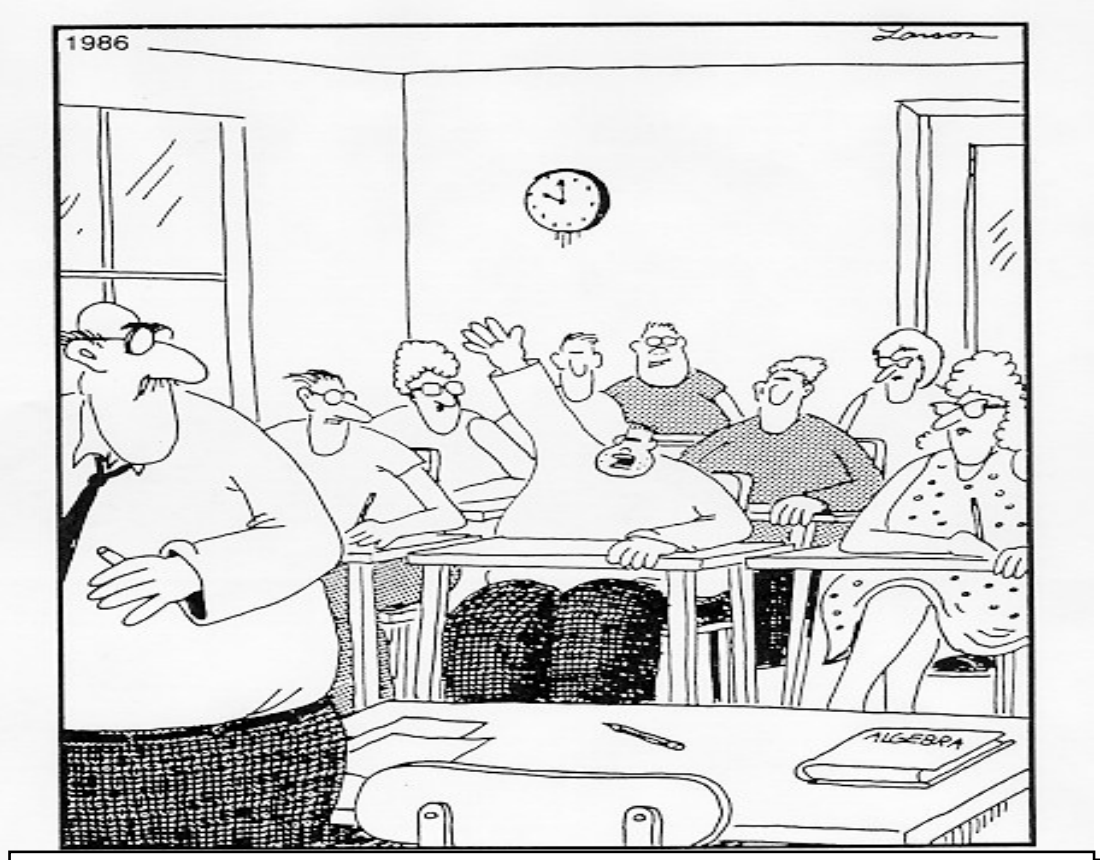
Summary

- FY 2000 Year in Review
- Human Error Models
- USAF Human Factor Taxonomy
- Investigation and Analysis Examples

Headquarters U.S. Air Force

Integrity - Service - Excellen

Questions ?



"May I be Excused?! My Brain is Full!"

U.S. AIR FORCE